THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXVIII. No. 2005.] LONDON, OCTOBER 15, 1901. [53RD YEAR. PRICE 6d.

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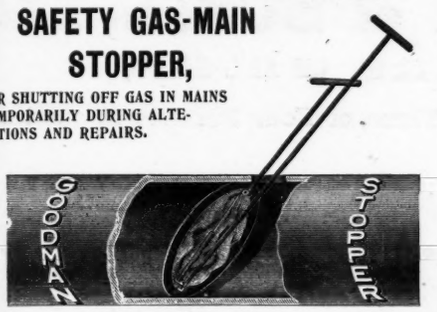

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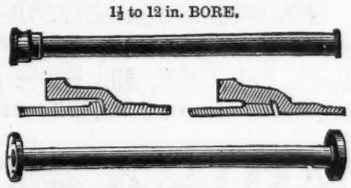

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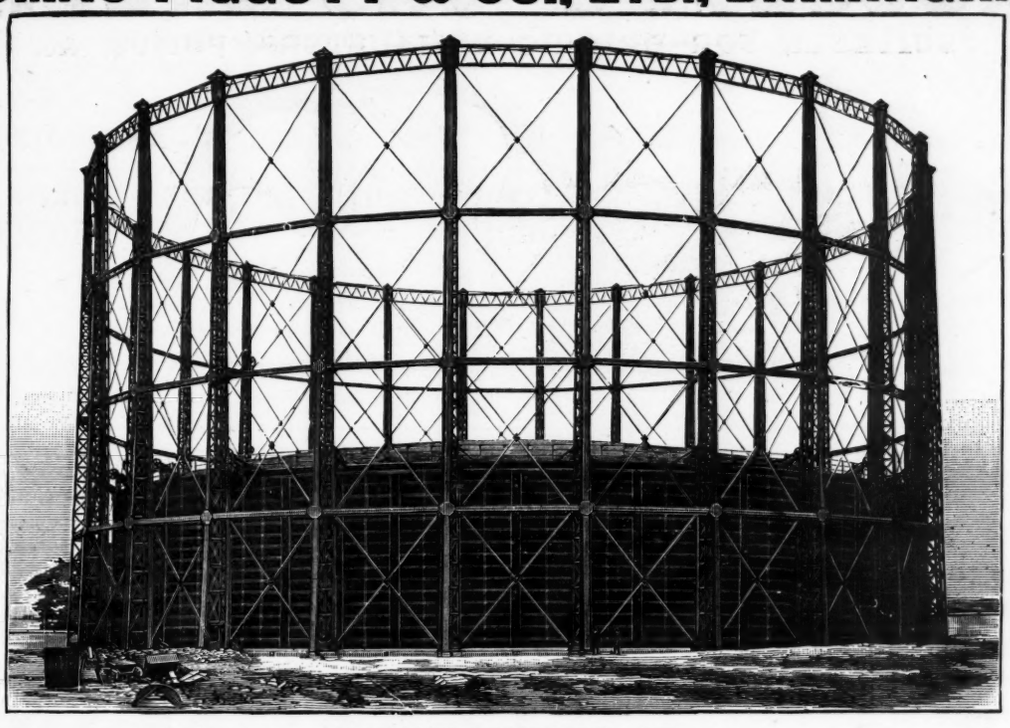

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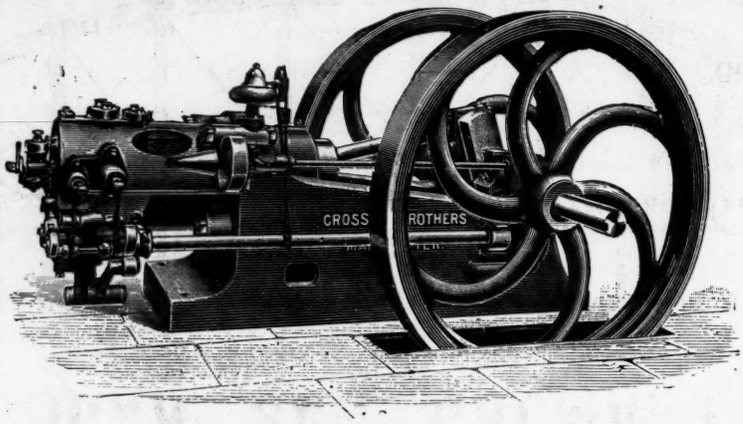

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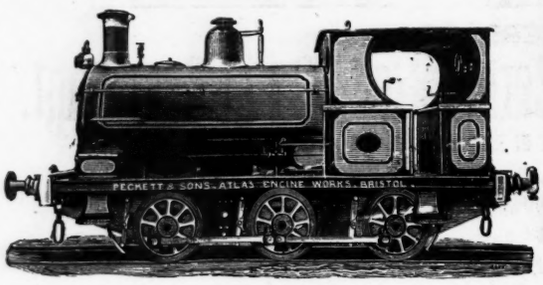

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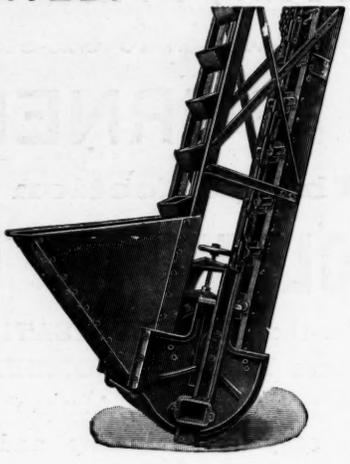

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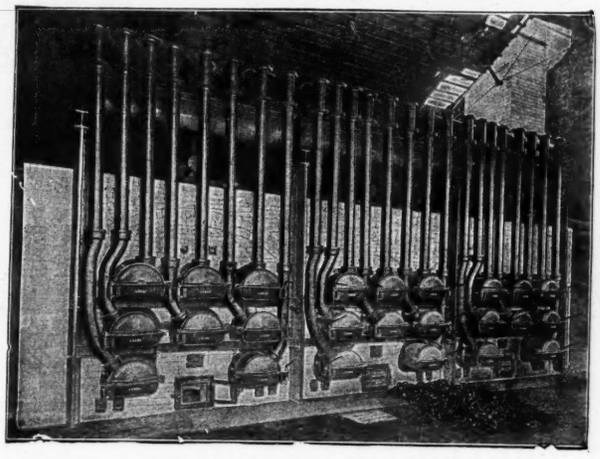

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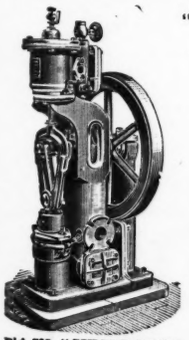

Fig. 703. "SINGLE RAM" STEAM-PUMP.

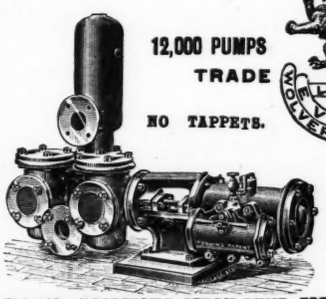

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

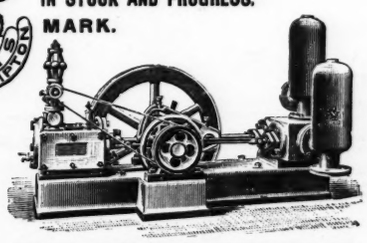

Fig. 688. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 719. "DOUBLE-RAM" STEAM-PUMP.

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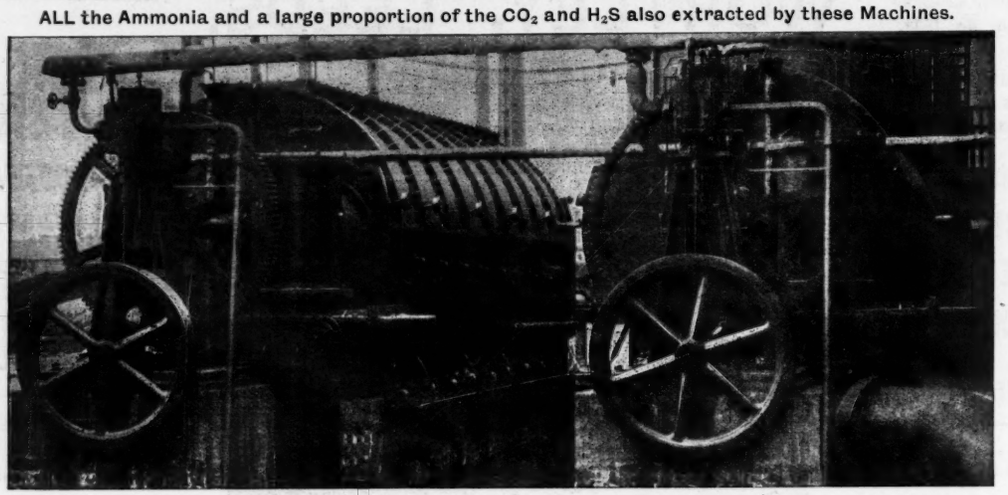

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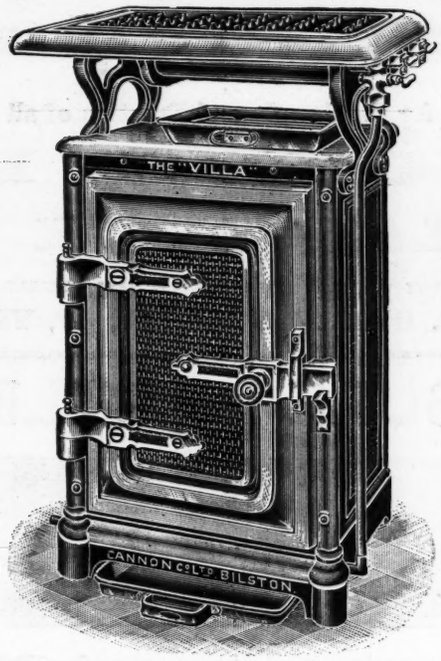

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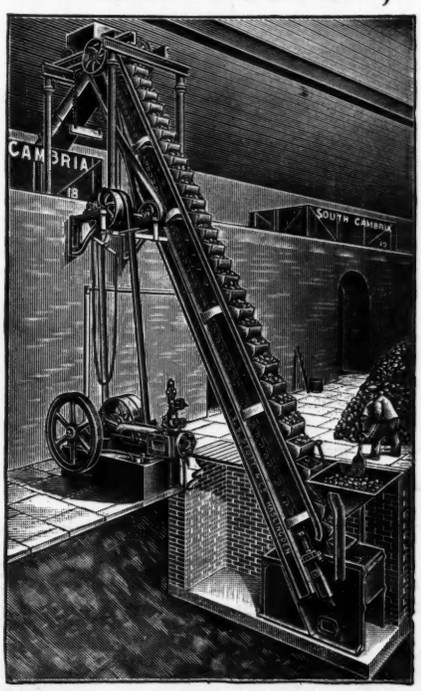

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CONTENTS.

EDITORIAL NOTES.

GAS, LIGHTING, &c.—
The Honour of British Municipalities . . 957
The Coal and Coke Markets 957
A Lawyer on the Law 958
Mr. E. Garcke upon Sir F. Bramwell . . 958
The Dover Boring 959
Financial Responsibility the Redemption of Trade Unions 959
WATER AFFAIRS—
Another Purchase Scheme Abandoned. . 959
The Sanitary Institute Conference on Water Supply 960
Water Supply for Jerusalem 960

ESSAYS AND REVIEWS.

Gas Acts for 1901 961
Fresh Views on the Remuneration of Labour 961
Chemical Instruction and Chemical Industries in Germany 962
Electric Lighting Memoranda 963
Gas and Water Stock Market 964
Wilson's Gas Motive-Power Plant 964

NOTES.

A Novel Gasholder Tank. 966
Tests of Coking Coal with Pyridine . . . 966
The Most Economical Forms of Light . . 966
Energy of Solar Radiation 966

COMMUNICATED ARTICLES.

Lewis Thompson and the Early Days of Gas Lighting. By W. J. Warner 967
Auditing Gas-Works Accounts 969

TECHNICAL RECORD.

Modern Gas Practice 971
Testing of Gas by Municipalities 973

TECHNICAL RECORD (*continued*)—
Removable Gas-Fire Burners 974
A New Pipe Joint and Connection 974
Incandescent Street-Lighting in San Francisco 975
Development of High-Power Gas-Engines . 975
Producer Gas and its Applications. . . . 975
Position of Calcium Carbide and Acetylene . 976
Abridgments in Chemical Calculations . . 977

REGISTER OF PATENTS.

Incandescent Lighting Bodies—Meyer, G. . 978
Extracting Naphthalene from Gases—Breittmayer, L. 978
Bunsen Gas-Burners—Walker, M. S. . . . 978
Regenerative Gas-Lamps—Hoffman, P. C. F. 979
Patent Notices 979

CORRESPONDENCE.

Income-Tax Assessment Allowances for Wear and Tear 979

LEGAL INTELLIGENCE.

Charge of Stealing Gas 979

MISCELLANEOUS NEWS.

Incandescent Gas Lighting in Newcastle-on-Tyne—Electric Lighting Displaced . . . 980
Gas Management at Widnes 980
The New Municipal Gas-Works at Zurich—Results of the First Year's Working. . . 980
Incandescent Trust, Limited 980
Trade Unions and the Taff Vale Judgment—Opinion of Counsel. 981
Bradford Corporation Gas Supply 982
Electric Lighting Notes 982
The Sanitary Institute and Water Supply . 982
The Bristol Corporation and the Water-Works—Purchase Abandoned 983
Stock and Share List 983

MISCELLANEOUS NEWS (*continued*)—
Bradford Water Supply — Proposed New Reservoir 984
Exeter Water Supply 984
Notes from Scotland 985
Current Sales of Gas Products 987
Coal Trade Reports 988

PARAGRAPHS.

Personal 956
Kitson Lights for Lighthouses—Preliminary Investigations for Water Supply 974
Masonic—Electrolytic Hydrogen for Incandescent Gas Lighting 977
Newcastle and Gateshead Gas Supply. . . 979
Land for the Leeds Water-Works Extensions 981
Cirencester Gas Company—Reservists' Fund at the Windsor Street Gas-Works—Breaking Up Roads in London—A Financial Critic of the Gaslight and Coke Company—Incandescent Gas Lighting at Sheffield—Rhos in Darkness 989
Otley Water Supply—Margate Water Supply—Nottingham Water Supply — Enfield Water Supply—Fight for Water Rights in Spain—Investment of Trade Union Funds—Pensions for Birmingham Corporation Employees 990
Increased Storage at the Solihull Gas-Works—Cardiff Water Supply — Water-Works Depreciation Account and the Repair of a Filtering Tunnel—Suffocation by Gas—The Destruction of a Dam at Dover—Hemel Hempstead Water-Works Purchase. . . 991
Todmorden's New Reservoir—Provincial Gas and Water Shares and Stock—Extension of the South Molton Gas-Works—Water Supply Scheme for the Bridgwater District 992

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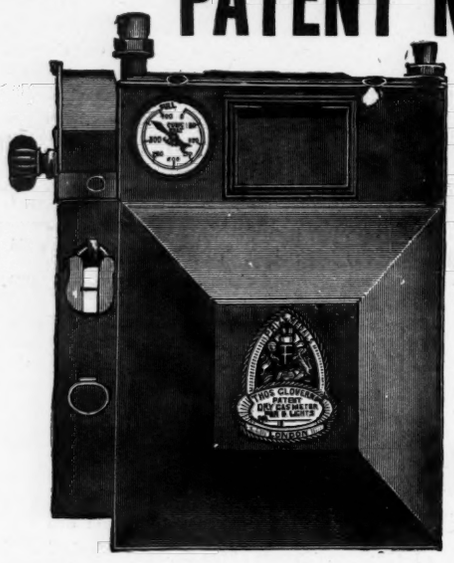

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EDITORIAL NOTES.

The Honour of British Municipalities.

THE English people are reasonably proud of the purity of their national and local governments. A corrupt Executive at Whitehall is a dream of the bad old past; and the age has also long gone by when the machinery of municipal government was employed unblushingly to serve the private ends of the members of municipal corporations. It is, however, as necessary as ever that the public conscience should be carefully attuned to the true key-note of integrity in the administration of public business of all kinds. It is one of the inherent weaknesses of humanity to exalt the form and the letter, while neglecting the spirit and the truth. Consequently, of recent years the country has experienced an unedifying "chivvying" of certain public men on account of their private financial and commercial relations; while others have been permitted to advertise unchecked the interested nature of their own participation in public business. The old "wheeze" about the reputation of Cæsar's wife has been paraded for the discomfiture of statesmen who happened also to be shareholders and directors of companies; but it is never mentioned when it might bring a blush to the cheek of the paid Trade Union delegate, whose sole care is to save his supporters all avoidable exertion.

Moreover, as a contemporary recently pointed out, it is not only personal honesty which members of local authorities in their individual capacity owe to the community that has elected them to honour. This, after all, is not a rare quality with English people. What is required of local authorities, as a rule, both individually and collectively, is a high degree of adherence to the canon of fair dealing with persons and interests with whom they have business relations. This, unfortunately, is not invariably found. Many local authorities, as a whole or by their committees, or even by the mouths of their representative members and officials, do unfair, tyrannical, and mean things of which privately their members would be ashamed. To vilify the quality of the service rendered to the community by a gas company, a water company, or a tramway company, in order to depreciate the value of the property on which their covetous desires are fixed, is a besetting sin of local authorities. See what the London County Council have stooped to do in this way, and there will be no further mystery as to how this important body have forfeited the respect of so large and influential a section of Parliament and the community.

What would the London County Council and their newspaper supporters have said if the London Water Companies had failed London, as the much-vaunted municipal water supply undertakings of the North of England have failed their public? Can anybody doubt that there would have been an uproar at Spring Gardens, and that no extenuating circumstances advanced by the Companies would have received the smallest grace? Did not the London County Council prevent the East London Water Company from making a reservoir betimes, and then abuse them for not having sufficient storage capacity? The recent troubles of the Northern Municipalities, to which attention was called in last Tuesday's "JOURNAL," are mostly due to their own fault of lack of foresight. Some had reservoir sites, but no reservoirs; others had reservoirs full of water, but insufficient trunk mains. This year has brought a sharp exposure of the weakness of municipal management of water undertakings, and other things.

During the last few days, the new Westminster Corporation have had to meet a sharp criticism directed by a Ratepayers' Committee to the circumstances of the Corporation's woodpaving contracts. It is not for us to go into the matter of these complaints, which it is understood may come before the Courts; but the subject is of interest in connection with main-laying operations. It is well known that the cost of road work, where the most expensive kinds of surfacing are used, comes heavy upon gas and water companies. But, on the other hand, the public complain bitterly of the frequency of roadway disturbances in main thoroughfares. As "The Times" lately put it, there is a loud demand for something to be done, "so that the roadway laid down and "made good by the gas company on Monday should not be "torn up and rendered impassable by the water company "on Tuesday." Mark how the natural citizen immediately pounces upon the gas-pipes, and after them the water-pipes, as the typical troublers of street passengers; the fact being that of all the disturbances of the main thoroughfares of towns, those directly caused by the necessities of the distribution of gas and water are among the rarest. Gas companies often suffer, undoubtedly, for the operations of other users of the surface and the subsoil of the streets; but the occasions when they are compelled to tear up an extensive area of first-class pavement on their own initiative are infrequent. To judge from some newspaper writers, it might be thought they enjoy doing this. The truth is the public do not feel the inconvenience one-half as keenly as do the companies who have to pay for as well as suffer it.

The alleged scandal in the case of Westminster is that the contractor has supplied inferior wood blocks, which assertion is, of course, denied. What the London Gas Companies find to complain about, in the wood pavement which represents the height of luxury in paving, and is accordingly much affected by the poorest districts, is the outrageous extravagance of laying it down in streets where it is not required. This matter of extravagance, again, is something that local authorities ought to make a point of collective conscience. There are miles of London streets paved with wood, where anything else would have been preferable. Wood paving is dirty and offensive, when not frequently cleaned; and the latter service is apt to be neglected. It occasions great unnecessary expense to gas and water companies supplying these localities, all of which is absolutely wasted money.

The Coal and Coke Markets.

THE Board of Trade returns for the month of September show a continued decline in both the iron and coal trades. So far as the iron and steel trades are concerned, we are now comparing with a period of last year in which the falling-off in business was strongly marked; the tide having turned in the second quarter of 1900. This will be made evident if we state that, though the total exports of iron and steel for the first nine months of the past year were 2,798,002 tons, compared with 2,683,345 tons in the same period of 1899, the exports for the month of September, 1900, were only 259,789 tons, as against 336,684 tons in September, 1899. This, it will be seen, was a very heavy decline from the business done at the height of the trade revival; but the figures for this year show a still further decrease, the exports last month being 246,959 tons, and during the nine months only 2,188,698 tons. It is merely necessary to compare these figures with those previously quoted to see in what a different position our foreign trade in iron and steel stands to-day from what it did in the early part of last year. A decrease of 610,000 tons (equal to 22 per cent.) in nine months is not a small matter. Taken in conjunction with an increase of 53,000 tons in the imports of iron and steel, it means a considerable slackening of work in the factories, and a proportionate reduction in the consumption of coal.

In regard to the export of coal, the returns show a falling-off in sales of 315,845 tons for the month of September, and of 1,453,093 tons since the beginning of the year; bringing the figures, both for the month and the year, down to the level of 1899. Against this must be set increases in shipments of bunkers, of 87,622 tons and 1,296,241 tons during the past month and nine months respectively; leaving a net decrease of 228,223 tons in September, and of only 156,852 tons since the 1st of January. The returns, therefore, show —for the first time since the imposition of the coal-tax made buyers and sellers alike eager to get their contracts completed within the period of exemption—an actual decrease on the year's shipments. The anticipation of deliveries, caused by the desire to secure exemption from duty, and accelerated by the fall in freights, will inevitably have the

effect of producing in the coming months a decided "slump" in the coal market.

Signs of this coming depression are already evident in the steam coal trade, and also in the market for slack. The prices at which the Egyptian State Railways have been able to secure their by no means inconsiderable requirements of Welsh coals (the published particulars show a contract price equal to something between 2s. and 3s. below current rates), and the decline of quotations in the Northern steam coal market, show that competition is becoming keen; while Midland and Yorkshire owners are now finding considerable difficulty in unloading their increasing stocks of slack. Furthermore, whatever effect the export tax may have on our foreign coal trade has not yet been, but soon will be, felt; the impost coming into full force at the end of the year. That it has already had some small effect would appear from the published figures as to the imports of coal and coke into Hamburg during the present year. For the nine months, the imports from the United Kingdom show a falling-off of 250,000 tons; while those from Westphalia increased by 90,000 tons—a shifting of business partly due to the tax and partly to the dulness of trade in Germany.

Altogether, the outlook for coal buyers is distinctly good. The prospects of trade in Germany, Russia, Belgium, and France are not such as to lead one to expect any revival in our exports of either iron or coal to those countries, and there is no sign of any decided expansion of business at home. At the present moment, those people whose requirements of gas coal are not fully covered by contracts find the market against them; but that state of affairs is in large measure due, we believe, to the fact that most consumers have bought pretty fully and are well up in stocks, though partly occasioned by the anticipation of foreign shipments to which we have already referred. No anxiety need be felt as to the future of the gas coal market. Prices should be lower, not higher, than they were this year, when the contract-making season again arrives.

As to coke, the position of affairs is not wholly satisfactory. The want of agreement between the largest producers is having the anticipated untoward effect upon the market; and the prices which might with ease have been secured three months ago for the contract year which has just begun, had the business been handled adroitly, are not being obtained. We have known for some time, and the matter has now been referred to in the trade journals, that the South Metropolitan Company have found it to be policy to reduce the contract price at which they had sold a good proportion of their coke from 12s. 6d. to 11s. 8d. per ton gross—a step which they may have been led to take by the fact that their buyers had heavy arrears to receive at the very high prices ruling under the expiring contracts. However that may be, the fact that such an adjustment has been made will render the task of other companies in obtaining the higher price—one which, we are convinced, could have been had for the asking in August, had not the market been disorganized and rendered nervous by injudicious handling—a somewhat difficult one. The situation requires knowledge and nerve on the part of those dealing with it; and those who are known by the buyers to possess these qualities are likely to come best out of it.

A Lawyer on the Law.

It is a rather remarkable circumstance that the English political world is ornamented at the present time by two prominent Solicitors, who have taken to public life—for which they unquestionably have a genius—without abandoning their connection with the law. One of these politico-legal luminaries is Sir Albert Rollit, who is identified with the politics of Municipalism. He is the typical Town Clerk of the Age, who entertains no doubt as to his own fitness for managing all possible affairs of his Corporation to the general advantage. For him, Parliament exists chiefly to sanction the aspirations of the Association of Municipal Corporations; and the notion that a Town Clerk might err is wholly inadmissible. The other eminent attorney in politics, Sir Henry Fowler, is otherwise inspired. He is not so fond of seeing individual initiative and enterprise suppressed in the supposed interest of local governments, and is too deeply conversant with the inside of provincial affairs to accept the gospel of Municipalism as adequate to redeem the country. Sir Henry, as President of the Incorporated Law Society, delivered last week, at the annual meeting, an address which is well worth reading.

As a Solicitor unburdening his soul among friends, Sir Henry Fowler freely expressed his views in regard to the actual state of the law and the merits of contemporary legal procedure. He surveyed the legal history of the past century, and found in the changes of the law of the land which marked this period "an aggregate of legislative achievements unparalleled in either ancient or modern jurisprudence." Still, matters in the legal world are not quite perfect. The Judicature Acts have effected much; but they have not reduced the expense of litigation. On the contrary, the cost of obtaining justice in the High Court is greater. Sir Henry Fowler had not a word to say as to how this feature of English justice can be modified. Passing to the making of the laws, he uttered a few trenchant words which are an echo of remarks that have before now appeared in these columns. Sir Henry Fowler has no patience with the liberty taken by some Judges, both of Superior and Inferior Courts, in criticizing the drafting of Acts of Parliament. He did not say, as we have done, that this fault-finding comes with bad grace from men who have occupied seats in Parliament themselves, and are well aware of the great preponderance of the legal element in the House of Commons. Lawyers, of all men, ought to know how it is that some Acts of Parliament contain ambiguous language. They are drawn in the first place with the utmost care by competent public servants; but, in the turmoil of the Committee stage, first one amendment and then another, intended to improve the measure, is tacked on to a Bill, until it becomes very difficult to understand what is really enacted. Sir Henry's remedy for this trouble is to refer the final product of the wisdom of many counsellors back to the dispassionate draftsman, in order that an opportunity should be afforded of amending any errors of language, any confusion of meaning, or any conflict with existing law, to which the attention of Parliament would thus be drawn. So simple a prescription is sure to be rejected. It would merely make the "Report" stage a reality, instead of a sham; and this would never do. It would be something gained if all members of a Parliament that passed an Act criticized by the Courts would accept their proper share of responsibility for its verbal defects; for every member might make himself useful in correcting mistakes—if he would take the trouble to do it.

Mr. E. Garcke upon Sir F. Bramwell.

The handsome testimonial by Sir Frederick Bramwell to Mond gas for South Staffordshire, has been duly noticed in the "Journal." From the political standpoint, he rejoices that Parliament withstood the desires of the gas-supplying Local Authorities who opposed the Mond Bill, and thinks it an obvious and proper retort that such authorities should be asked why, if they elect to go into trade, they should be spared the ordinary risks of traders. Seeing that, when the Bill was in Committee, the promoters averred with all the force at their command that they did not contemplate touching the business of the local gas undertakings at all, this is a pretty good endorsement of the assertions of the witnesses for the opposition who said that this competition would, of necessity, ensue on the starting of the venture. However, perhaps we had better wait for the Mond Gas Company to get to work before arguing any more as to where their customers will come from. Our present reason for referring to Sir Frederick Bramwell's letter is to notice a rejoinder by Mr. Emile Garcke, who, as everybody knows, is against the idea of municipal trading in all its branches. He wants public opinion to revolt from the notion that the making of gain is a proper object for municipal effort. That is what people engage in business for; but when the same end that is rightly and properly pursued in the shop is followed in the municipal council chamber, confusion and wrong result. The difficulty is a very old one; but Mr. Garcke puts it so neatly that we cannot resist the temptation to quote him. Surely, he protests, the chief advantage of municipal enterprises is not that of transferring the profits of trade from private capitalists to the municipalities, but of rendering certain public services more cheaply and more efficiently than can be done by private enterprise. In short, we do not want municipal "trading," but we do want higher and nobler municipal "enterprise," free from the endeavour to make pecuniary gains. If we want better sanitation, purer water, good lighting, open spaces, or free libraries, we must pay for them by increased rates; and if commerce and industry are left free to expand along the natural lines, the money for all these and other things will be forthcoming. The modern tendency is for local authorities to pay more attention to undertakings that appear to be remunerative

than to the troublesome, but necessary, services which only cost money. The principle to be regarded is that the mere making of profit is not a sufficient inducement for local authorities to go into trade. If, nevertheless, profits are made out of municipal enterprises, then these should be applied, not to the reduction of the rates, but to the reduction of the capital account and the price of the services rendered. This has been the contention of the "JOURNAL" all along; and its unfashionableness up to the present has not in the smallest degree weakened our adhesion to it.

The Dover Boring.

THE report made by Professor R. Etheridge, F.R.S., to the Board of the Kent Collieries Corporation, on the coal cores recently taken out by means of the calyx drill, would seem to indicate that the ill-luck by which the enterprise has been repeatedly overtaken has not yet deserted it. The report (which is, of course, of an extremely technical nature) states that "there are some very bright and sparkling streaks in "the coal; but the great bulk of it is argillaceous in cha- "racter, and shows abundant slickensides typical of fault- "ing." In Professor Etheridge's opinion, there is no doubt whatever that the drill has pierced the seam close to a fault or bend, existing between the original Brady bore and the No. 2 pit. He is confirmed in this view by the fact that the seams entered by the calyx drill are 8 feet lower than those in the Brady boring. It will therefore be necessary to open out the seam beyond the influence of the fault before the normal character of the coal can be arrived at. Though the existence of this fault is to some extent disappointing, it was not expected that the seam of coal now struck would be of first-class quality. It is to those between the 1200 and 2200 feet levels that attention will be turned. In the original boring, no less than seven seams of 2 feet and upwards in thickness were passed through before reaching the latter depth; and there seems no reason to doubt that these discoveries will be confirmed by the much more reliable method of drilling now employed. The shaft itself has already been sunk to a depth of 1100 feet; and the definite knowledge which is now being gained of the strata still to be passed through will greatly facilitate its completion down to the coal measures.

Financial Responsibility the Redemption of Trade Unions.

THE fuglemen of political Trade Unionism in this country have been indulging in much lamentation over the recent House of Lords judgments, which threaten to make their Unions smart for their indiscretions. A good deal of this agitation is probably due to the existence of an uneasy feeling on the part of these vociferous persons, that possibly their places of emolument and distinction may not be quite so secure under the new dispensation. A curious reflection of this sentiment appears in some editorial comments of the "Engineering Magazine" upon the late abortive American steel workers' strike. This also was a sharp disillusionment for the mountebanks who had flattered themselves that they were Napoleons of Labour. In both cases, the Trade Union leaders have been made cognizant of their own littleness; and the lesson, while it may help forward the cause of wise and well-ordered Trade Unionism, has probably finished the vogue of the old ignorant and vapouring demagogic officials. These men have flourished by virtue of their irresponsibility. So long as the funds of the Societies they represented could not be attached to pay for their vagaries, they did as they pleased. Now, if the ordinary members of Trade Societies are wise, they will perceive that these organizations, like all other institutions, must be reasonable, just, and responsible. If they permit dreamy Teutons or seditious Irishmen to get their Societies into trouble, they will have to pay for it.

Our contemporary opines that when Trade Unions regard themselves, or are compelled by the Courts to hold themselves, responsible for their agreements and their actions, this one new condition will quickly bring to their leadership men of sufficient calibre to direct them with justice and with reason. The old theatrical type of leader, leather-lunged and reckless, who tickled the fancy of the younger workmen, will suffer a permanent loss of engagement. "When a vote "carried no responsibility, it was lightly cast for the labour "demagogue of smooth tongue, of fair promise, and of light "allegiance to ideas of right or order. But when the work- "ing man realizes that his ballot involves his material "interest in exactly the same sense and proportion as "does that of the shareholder in a corporation, he will be "more discriminating." In other words, men like Schaffer, the late organizer of the steel workers' strike, will become impossible. The writer goes on to remark that recent newspaper reports indicate that the British Trade Unions, alarmed at the House of Lords decisions, seek to minimize their tangible responsibility. "Their way to success and "prosperity," it is shrewdly observed, "as well as to sound "usefulness, lies in frankly and fully accepting it. They "cannot force 'recognition;' but they can win recognition "by showing themselves responsible." There can be no question as to the wisdom of this observation. How long it will take to find acceptance where it will do most good is another thing.

WATER AFFAIRS.

Another Purchase Scheme Abandoned.

FOR a period of something like seven years, the Bristol Corporation have had under consideration—not continuously but fitfully—the question of acquiring the undertaking of the Water Company. The Corporation doubtless reasoned somewhat after this fashion: The supply of such a necessary of life as water should be in the hands of the Local Authority; nearly all the important towns in the kingdom have purchased their water-works; Bristol is an important town, and therefore it should follow the example of the others. The conclusion thus come to led to the passing of various abstract resolutions affirming the desirability of the water supply of the city being municipalized; and eventually the matter was entrusted to a Special Committee, with the view of all the necessary steps being taken to achieve this result. Owing to certain local circumstances, nothing definite was done until the spring of 1898, when the Committee presented to the Council a report which was calculated to check further proceedings. It was to the effect that the Directors of the Company were not prepared to enter into negotiations for the disposal of their undertaking. Undaunted by this rebuff, the Council deferred the consideration of the report until the Committee had answered three questions framed with the view of ascertaining whether any reduction in the Company's charges could be enforced, whether they compared favourably with those of other towns, and whether the supply was adequate. After deliberations and investigations extending over three years and a half, the Committee answered the first question in the negative and the last in the affirmative. As to the second, all they could do was to submit an elaborate schedule of charges in force in six large towns, some being in favour of, and others against Bristol. The outcome of their long inquiry was that, as the Company declined to sell their undertaking, they did not feel able to recommend the Council to apply to Parliament for powers to buy compulsorily.

The report embodying this conclusion came before the Council last Tuesday, and received the support of practically the entire body; for the few members who still clung to the idea of purchase, and would have risked defeat in Parliament in an attempt to carry it out, scarcely obtained a hearing. It is fortunate for the ratepayers that this was so. We feel pretty sure that the Corporation would never have been able to justify before a Parliamentary Committee a demand for the compulsory transfer of an undertaking which, on the showing of their own Committee, had not failed to meet the calls upon it; and it would not have added to their dignity to have to submit to such a snub as that which was administered last session, under similar circumstances, to certain Corporations in the North of England. It is acknowledged locally that Bristol has "one of the finest water supplies in "the kingdom," and that "the service has been uninter- "rupted, even when some other parts of the country have "been driven to the direst straits by drought." To what, we may fairly ask, is such a condition of things attributable? Unquestionably, to the foresight of the Company's engineering adviser, and to the business capacity of the directorate. There is no living from hand to mouth—no "muddling "along somehow"—in connection with the water supply of Bristol; and the result is that the Company find themselves in possession of storage equal to 2400 million gallons of water, the purity of which has been safeguarded by recent legislation. They are justifiably proud of their undertaking, and are naturally desirous of keeping possession of it; and inasmuch as the Bristolians could not be better or more cheaply served if it were transferred to the Corporation,

while the necessarily heavy purchase price would involve an addition of something like 2d. in the pound to the rates, a wise course has assuredly been followed in leaving the water supply in the hands of those who now control it.

The Sanitary Institute Conference on Water Supply.

In a previous issue of the "Journal," reference has been made to the conference on water supplies and river pollution which is to be held in London to-morrow and the next day, under the auspices of the Sanitary Institute; and it will be seen, by the programme which appears elsewhere, that the proceedings promise to be of a highly interesting and instructive character. The subjects to be brought forward are so numerous, however, that we are afraid the two mornings available for their discussion (for the afternoons are to be devoted to visits) will scarcely suffice for their adequate treatment, especially in view of the large number of delegates who, it may be supposed, will be desirous of speaking on the different questions. The papers set down for the first day, when Sir A. R. Binnie will preside, deal with watershed areas and the prevention of their contamination, rainfall and population in relation to water supply, the rivers of Glamorganshire and the adjacent counties, and the supply of water to villages, isolated and small groups of cottages, and village schools. The proceedings on the second day, when Mr. William Whitaker, F.R.S., will take the chair, will include discussions on river pollution and prevention within the watershed of the River Thames, the purity of water, and the commercial and industrial value of soft water. It will thus be seen that a wide range of subjects will come under consideration, and no doubt much light will be thrown upon them in the course of the debates. The visits arranged for the afternoons cannot fail to be instructive. On Wednesday, the fittings testing-shop of the New River Company at Clerkenwell will be inspected, as well as the works of the East London Water Company at Lea Bridge; while on Thursday the delegates will be afforded an opportunity of testifying to the excellent progress which has been made by the firm of which Sir John Aird is the head with the scheme that Messrs. Hunter and Middleton are carrying out at Staines, which will very shortly place at the disposal of the inhabitants of London a substantial addition to their store of water. The annual dinner of the Institute at the Holborn Restaurant in the evening will bring to an agreeable close two days of hard, but it may be hoped profitable, work.

Water Supply for Jerusalem.

As a most interesting instance of the adaptation of modern engineering to ancient cities, the project which is now on foot for providing Jerusalem with a supply of "living water" merits brief notice. According to an article which recently appeared in "The Times," the remains of ancient aqueducts and reservoirs testify to the abundant provision of water which the Holy City had when it flourished as the Metropolis of the Jewish State. But for a long time it has been dependent upon the scanty and often polluted accumulations of rain water, coming from the terraces of different houses, gathered in the rock-hewn cisterns beneath them. Even when these are filled, only a moderate supply is yielded; and by the end of the summer water becomes scarce, and fever and other sickness, resulting from the consumption of the dregs of the cisterns, naturally result. Last season, the rainfall was only about one-half the average of the past few years; and therefore the troubles which arise under normal conditions have necessarily been greatly increased. The deplorable sanitary condition of Jerusalem engaged the attention of the late Dean Stanley nearly forty years ago; and, under his auspices, a Committee was formed with the object of having an accurate survey made of the city and the neighbourhood. The project received encouragement and financial support from Lady Burdett-Coutts, who had evinced a keen desire to have the inhabitants of the city furnished with a supply of water. At the meeting of the Archæological Institute in July, 1866, Dean Stanley stated that the preliminary survey had been made with the view of this philanthropic object being achieved. It appears, however, that the unwillingness of the Turkish Government to accept the conditions attached to the offer of Lady Burdett-Coutts prevented the scheme from being carried out; and the efforts of a Committee in London were, for the same reason, not more successful. The project has, however, been lately revived, with every chance of success.

According to the correspondent of "The Times," there is in existence a fund or endowment, of ancient date, for giving Jerusalem a supply of water; but the income therefrom has been diverted into other channels. The arrival of a new Governor, and the occurrence of the Mahomedan feast of the birthday of the Prophet, resulted in permission being obtained from his Imperial Majesty the Sultan to appropriate from this fund the amount needed—some £5000—to bring in the water, by means of a pipe, from Ain Salah, or the "Sealed "Fountain," at Solomon's Pools, about nine miles south of the city. On the 5th of July last, the foundation stone was laid in the presence of the civil and military pashas, the Mahomedan religious heads, and a number of leading Turkish officials. The pipe will be only a 4-inch one; but it will deliver about 8000 "skins" per 24 hours. In addition to this source of water, a dozen ancient fountains, long neglected, in different parts of the city, are to be utilized for the free use of all who will draw from them. Inquiries are likewise being made as to the feasibility of bringing in an auxiliary supply from Beeroth—"the place "of wells"—whence, it is said, water was conveyed to Jerusalem in ancient times. It is confidently believed that from this source, at a cost of about £8000, a supply of spring water similar in quantity to that from the Sealed Fountain on the south can be readily obtained. Another interesting work in connection with the water supply of Jerusalem is the successful repair of the Virgin's Fount, in the Valley of Jehosaphat, just outside the walls of the city. This is a somewhat remarkable fountain. The water is brackish, and the flow small and intermittent—that is to say, after several hours' flow there occurs a short interval during which the water stops running. It passes into the Pool of Siloam through a tunnel reputed to have been built by Hezekiah, as testified by an inscription thereon in rude Hebrew. Professor Sayce, however, states that neither the name of the king who caused the tunnel to be built nor that of the engineer who executed the work is mentioned. We need not speculate on this matter; it is sufficient to record the utilization in these modern times of an unquestionably ancient piece of engineering work.

In the report of the proceedings at the meeting of the North of England Association which appeared last week (p. 909), the name of Mr. A. B. Walker, of Walker-on-Tyne, should have been given as that of the Vice-President of the Association, and the seconder of the vote of thanks to the President.

At the opening meeting of the new session of the Institution of Mechanical Engineers to be held next Friday, at their house, Storey's Gate, St. James's Park, the second report to the Gas-Engine Research Committee, by Professor F. W. Burstall, of Birmingham, will be read and discussed.

Application has been made to the Board of Trade for a licence directing an Association about to be formed under the name of the Acetylene Association to be registered with limited liability, without the addition of the word "Limited" to the name. The object of the Association is to "promote the advancement of acetylene gas engineering and manufacture, and to facilitate the interchange of information amongst the members of the Association, and the publication of information on such subjects."

The subject of the protection of buildings from lightning was brought before the Engineering Section of the British Association by Mr. Killingworth Hedges. It is admitted that lightning-rod practice has passed through many phases, and that considerable differences exist between the fashion of such preventives in different countries. This uncertainty, however, should not be held to excuse the neglect of the subject by architects and engineers of lofty structures, although it may go some way towards explaining it. Mr. Hedges in his paper gave an account of his own rearrangement of the lightning-rods of St. Paul's Cathedral, which, although erected so recently as 1872, were found on examination to be totally inefficient, both as regards the conductivity of the joints and the resistance of the earth connections. The lesson here is that those responsible for the custody of important buildings in a sulphurous atmosphere should keep a watch over the integrity of the lightning protection. In the cases of St. Paul's Cathedral and Westminster Abbey, both of which have passed through Mr. Hedges' hands, the number of ordinary conductors from air to earth has been greatly increased. Besides these, horizontal cables are run on the ridges of the roofs and in other prominent positions, so as to enclose the whole building in a cage; connection being made with the vertical conductors wherever they cross. The horizontal cables are furnished at intervals with spikes, or aigrettes, invisible from the ground level, and designed to give many points of discharge. The unreliability of soldered joints for conductors, whether a cable or tape, has led Mr. Hedges to design a special joint box. It appears to be better to keep lightning rods or tapes off from actual contact with the building. Mr. Hedges admitted that definite rules on the subject cannot be laid down until more information has been collected by the Committee now dealing with the matter.

ESSAYS AND REVIEWS.

GAS ACTS FOR 1901.

(*Continued from p.* 893.)

THE Aldershot Gas and Water Act empowers the Company to raise additional capital to the amount of £50,000, which is to bear a 7 per cent. ordinary or 5 per cent. preference dividend. If issued as preference capital, it is to rank next after the existing "E" preference shares of the Company. The limits of supply of gas are extended to include the parishes of Cove, Fleet, and Crookham, and such parts of the parishes of Hawley and Yateley, all in Hampshire, as are not included within the limits of supply defined by the York Town and Blackwater Gas Order, 1890; also the parish of Seale, Surrey. The price of gas chargeable in the outlying districts, beyond the parish of Aldershot, is not to be more than 1s. nor, for a period of seven years, less than 6d. in excess of the price for the time being charged within the parish of Aldershot. The existing powers of purchase now vested in the Aldershot Urban District Council by virtue of section 162 of the Public Health Act, 1875, are to extend to the whole of the limits of supply. Within six months from the passing of the Act, the pressure in the distributing gas-mains of the Company "shall be so regulated as to conform to what is normal and customary." If at any time thereafter the District Council consider that the pressure is excessive, they are to be at liberty to give notice thereof to the Company; and in the event of no sufficient reduction of such pressure being made within 14 days, the Council shall have the right of appeal to the Board of Trade on the point. A new official gas-testing place is to be provided within six months at the Council offices, at the expense of the Council. The gas and water undertaking accounts are to be separately kept. Additional land is sanctioned for storing gas.

The Bath Gas Act extends the limits of supply by the Company to include the parishes of Langridge and Woolley. The existing capital of the Company is consolidated upon a 5 per cent. basis. Additional 7 per cent. capital to the amount of £13,000 is sanctioned, whereof not more than £7000 is issuable as preference capital. The mortgage debt may be increased to one-third of the nominal amount of the consolidated ordinary stock issued in exchange for the existing capital stock. A clause provides that the position of consumers' meters shall be prescribed by the Company in order that the same shall be as close as practicable to the outside wall of the premises nearest the source of supply, and that the meter and fittings shall be open to the inspection of the officers of the Company; but provision is made that no alteration can be insisted upon at the consumers' expense.

The British Gaslight Company, Limited (Hull Station), Act authorizes the expenditure on the station of a further sum of £200,000, whereof £60,000 is to be borrowed at not exceeding 4 per cent. The proportion of capital stock is not to bear more than 5 per cent. divisible profit. Additional gas lands are sanctioned. Power is given to the Corporation of Hull to appoint an Auditor of the accounts of the Company in relation to the undertaking. The signature of such Auditor to the published accounts of the Company is not necessary; nor can he interfere in any way with the management of the undertaking. The Company are to contribute 25 guineas a year towards the Auditor's fee. The illuminating power of the gas supplied within the limits of the Local Acts of 1858 and 1876 is to be 15 candles; and the the gas is not to contain more than 30 grains of sulphur in 100 cubic feet—provided that no penalty on this account is recoverable if the excess of sulphur shall be due to unavoidable cause or accident, or be less in amount than 2 grains upon the average of six consecutive week-days, or 5 grains upon any one day.

The Chester Gas Act empowers the Company to acquire additional lands compulsorily within the next three years. No injurious matter is to be allowed to pass from the works into the city sewers. The Company's Act of 1858 is amended, as regards the liability of the Company to pay the Corporation for street openings, by fixing the rate of payment at 6d. per superficial yard. The existing capital of the Company is converted and consolidated upon a 5 per cent. basis. New capital is authorized, to the amount of £75,000, to bear 5 per cent. ordinary, or 4 per cent. preference dividend. In issuing new stock by auction or tender, preference, in the event of equal offers, is to be given to an old proprietor, or a consumer, or employee. The borrowed capital is fixed at £43,300 in respect of the old stock, and in the proportion of one-third of the new issues. Power to prescribe consumers' fittings is given; and also a general permission to make railway sidings into the works.

The Dorking Gas Act extends the Company's limits of supply over several parishes in the vicinity, having regard to the powers of the Leatherhead Company. The maximum price of gas in the home district is 5s. 3d., and 3d. per 1000 cubic feet extra for the outlying area. Additional capital to the amount of £30,000 is authorized, to bear a 5 per cent. dividend, with one-third borrowing powers. Ten per cent. discount to consumers is allowable. Gas of 14-candle power is to be supplied, free from sulphuretted hydrogen on a one minute test. In the event of the gas examiner finding any defect of illuminating power or purity in the gas, he shall forthwith give notice of the fact to the Company, at their office.

The Dover Gas Act changes the name of the Company to that of the Dover Gas Company. Additional gas lands are sanctioned. The capital of the Company is increased by £100,000, to be issued as 7½ per cent. ordinary, or 4 per cent. preference capital. Old proprietors, consumers, or employees are to have the preference in equivalent bids for the new issues. The new borrowing powers are in the proportion of one-third. The Company may use pipes for ancillary purposes. Interest on consumers' deposits is reduced to 4 per cent. Local authorities may be supplied with gas in bulk on not exceeding seven years' contracts.

The Elland Gas Act consolidates the existing capital of the Company, upon a 5 per cent. basis for ordinary, and 4 per cent. for preference stock. Additional capital to the amount of £45,000 is sanctioned—one half to be ordinary, and the other half preference stock; provided that the Company are not to create and issue further preference stock without the consent of three-fifths of the votes of the holders of existing preference stock. Four per cent. loan capital, in the proportion of one-fourth, is also sanctioned. As from Jan. 1, 1902, the standard price of gas is to be 4s. per 1000 cubic feet. Interim dividends may be paid. Gas of 15-candle power is to be supplied, tested, as before, on the works. Consumers' fittings are subject to inspection. The portion of the Company's undertaking in the district of the Halifax Corporation is vested in the Corporation, who pay the Company £1100 as consideration for the transfer.

The Gravesend Gas Act consolidates the capital of the Company upon a 5 per cent. basis, with the addition of £36,000, and one-third borrowing powers. The standard price of gas is 3s. 2d. per 1000 cubic feet. The authorized insurance and reserve funds are not increased by reason of the consolidation of the capital. Gas of 15-candle power is to be supplied.

The Newcastle-upon-Tyne and Gateshead Gas Act converts the existing capital of the Company into ordinary stock of twice the nominal amount, and the old preference stock into preference stock of one-and-a-quarter times the nominal amount, bearing a fixed 4 per cent. dividend. Additional stock to the amount of £900,000 is authorized. Holders of old stock, and gas consumers, are to have the privilege of taking new unsold issues at the reserve price. The limits of supply are extended, subject to the obligation not to supply outlying districts to the detriment of the home area. A scheme of consumers' discounts is sanctioned. Consumers' fittings are made subject to prescription.

The Newport (Isle of Wight) Gas Act empowers the Company to acquire additional gas lands compulsorily within three years. Certain leasehold lands held by the Company are to be acquired by them within five years. The Corporation have the option of purchasing the whole undertaking as it stands on Jan. 1, 1945. The limits of supply are enlarged so as to include the parishes of North and South Arreton. The capital is consolidated on a 5 per cent. basis, with power to increase it by £50,000. The borrowing powers are increased to one-third of the amount of the old and new stock. The standard price of gas is 4s. per 1000 cubic feet, with unlimited discounts. The usual consumers' fittings inspection clause is inserted.

The New Swindon Gas Act consolidates the Company's existing capital on the customary basis, and increases the authorized capital by £60,000, whereof no more than one-half may be issued as preference capital. The borrowing powers are in the proportion of one-third. The standard prices of gas are 4s. 3d. per 1000 cubic feet within the borough, and 4s. 6d. outside.

The Richmond Gas Act enables the Company to acquire and use additional gas lands, and consolidates the capital on the usual basis. The amount of the insurance fund is unaffected by the change. Further capital to the extent of £60,000 is sanctioned; old shareholders, gas consumers, and employees having the preference in case of equal bids for the new issues. The loan capital on the new issues is in the proportion of one-third. The standard price of gas is 3s, 3d. per 1000 cubic feet. The price charged for gas supplied to the public lamps is to be the lowest charged for the time being to any private consumer. New clauses dealing with pressure and purity of the gas supply are enacted. Gas is to be tested for illuminating power only between 5 and 11 o'clock in the evening. Pipes may be laid for ancillary purposes, with consent of the Corporation.

FRESH VIEWS ON THE REMUNERATION OF LABOUR.

BRIEF mention has already been made in the "JOURNAL" of the papers on workshop methods read by various authors before the Mechanical Section of the Engineering Congress. Really, these communications related to different devices designed to increase the output of the individual workman; to improve the efficiency of the workshop as a whole; and, in short, to benefit both employers and employed through the pocket. A good deal was said on this occasion about the premium system of remunerating workmen; and as the "JOURNAL" was early in introducing this system, which is of American origin, to the notice of the English trade, we are naturally interested in watching its fortunes. It is agreed by those who brought the subject forward at the Congress, that the premium system has worked a complete revolution in the shops of which they are able to speak. The nature of this plan of remunerating extra-efficient labour was sufficiently explained

in our first article on the subject (see "JOURNAL," Vol. LXXIV., p. 294), and therefore need not be stated over again. The chief thing to be borne in mind concerning it is that it is not the same as piecework. We are not going to enter upon the time-worn discussion of the merits and demerits of piecework, chiefly because no general answer can be made to fit the diversified forms into which circumstances cast the question.

The premium system is, on the face of it, extremely simple. As applied in engineering works, it means that a man, or a gang, who can save time on the period allotted for the execution of a particular job, receives a fixed proportion of the money saved—say, one-half of it—over and above the ordinary pay for the time actually worked. One of the immediate benefits of this arrangement is that it weighs the men in a true balance. Remarkably enough—although the fact is so familiar that the writers of the Glasgow papers did not notice it—the test of the workman's efficiency has come to be that of the time he takes to do his job, whatever it may be. There is no longer any question of good or bad workmanship. That is a matter of planning, and of tools chiefly machine. In other words, the administration charges itself with the care of the quality of the work turned out, and relies upon the operatives employed solely in respect of quantity. Where this condition prevails, the way to the greatest output evidently lies in enlisting the interest of the workpeople to stick at it steadily and well—in making it worth their while to save even minutes if they can. Economizing time, rather than increasing physical exertion, is the question here.

The premium plan is exactly adapted to this state of affairs. By making it worth a workman's while to save all the time he can, it has the consequential effect of setting his wits to work to devise and suggest ways of effecting this economy. The chief difference between the journeyman mechanic who stands by the lathe, and the manager who walks the shop, is that the former has under the wage system no interest in thinking about cost. Consequently he is apt to grow dull, stupid, and unprofitable in his work; while he looks for advantage outside his employment. It is testified that the new system offers a real inducement to the workman to suggest improvements in his tools or machines. The next advantage is that it procures the establishment of accurate data upon which estimates of labour costs can be made. Apart from this, the system provides an excellent check upon any excessive rise in wages costs, as every cause of expense can be detected at once. Extravagant and wasteful shop arrangements, and obsolete and defective tools, are exposed in the same way.

One engineer testifies that the premium system, with all its attendant records, very soon showed up the benefits of standardizing; as the saving of time was quite considerable where a run of identical or nearly similar pieces could be given to a machinist. Observance of this point reacted upon the drawing office, leading what is vaguely called "our practice" along definite lines—thus avoiding irritating and expensive changes and oversights. Messrs. W. Weir and J. R. Richmond, of Glasgow, found it advantageous to supplement the premium system with a Foreman's Club, a Suggestion Scheme, a Technical Committee, and an Intelligence Department. These titles of an expanded organization almost explain themselves. The Foreman's Club meets to discuss and settle all shop problems. The Suggestion Scheme settles monthly the awards to workpeople for the best suggestions leading to improvements. The Technical Committee deals with new designs and experimental work, and systematically considers complaints and defects. The Intelligence Department collects data and prepares information for the use of various departments in the works. All this spells organization; and argues the existence of a close interest in the prosperity of the works at headquarters. The latter is not so common as some people might be led to think.

These remarkable organizers have instituted what they call a "Friction Club." The purpose of this invention was to secure adequate discussion of shop problems, and a systematic carrying out of suggestions and reporting of results. The membership of the club comprise the foremen and all the administrative heads of departments. When the club was first proposed, it had not a favourable reception. It was considered by the foremen that the discussions would breed dissension, and that debate would descend into personalities. It was accordingly named the "Friction Club," on the principle that its mission was to be the elimination of internal friction from the establishment. The rules were made as elastic as possible. Its Executive consists of a Committee of five, whereof three are Chairmen, presiding in succession, and two Joint Secretaries. Meetings are held once a month, in the evening. A club letter-box is provided in the shop, into which members are requested to drop memoranda on subjects they wish discussed at the next meeting. Although the work of the club started with some misgivings, it has improved as time went on, until now it is a most helpful factor in the establishment. Such practical matters as the lighting of the shops, the wearing of overalls by the men, and so forth, have been settled by the club.

Another useful institution is the Intelligence Department. This branch deals with the collection, cataloguing, and indexing of all sorts of technical information likely to be useful in the works. It is served by a portion of the clerical staff in the intervals of their regular employment; and the results are found to be of real help to the managers and other expensive officers who wish to know from time to time what has been published concerning subjects remitted to them to deal with. All this sounds very good; and the authors of the paper have done a real service to the industrial community in thus exhibiting the course of development of these various schemes for disposing of the minutiæ of an engineer's establishment, which may be followed up with advantage. Of course, systems must be made to fit the works in which they are applied. What suits an engineering works may not be suitable for a colliery, a spinning-mill, or a gas-works. The ruling idea is, however, the same—it is the principle of mutual help, resting on mutual advantage, and brought down to the small details of workaday life. It is not a matter of politics, as of the formal union of employers and employed, such as is talked about on platforms; it is strictly domestic.

Mr. George Livesey, according to our report, discussed the premium system, and concluded that it is not so good for men as his own plan of copartnership, which, he contends, succeeds in doing the workman permanent good. While yielding to none in admiration for the work that Mr. Livesey has done in this connection, we must reserve the liberty of criticising the semi-compulsory operation of his scheme, on the ground that it measures up all the virtues of the workman by the single standard of thrift. Mr. Livesey may be justified by experience in applying this test—ability to put by extra earnings—as the one sufficient gauge of a good gas worker. But it is not a test of universal applicability. Where the work to be done is calculated to exercise the intellect, a man who has unsatisfied wants and unrealized ambitions (and is consequently chronically short of cash) is likely to have more initiative than the man who can save half-pence because his wants are few and small. In holding this view, it is not necessary to go to the extreme, and magnify the significance of the truth that occasionally a great scamp is an excellent workman. All that need be remembered is that the moral qualities of thriftiness, sobriety, and steadiness may be possessed by an ineffective man. The "good young man" of the Y.M.C.A. may or may not be a smart hand at his work. If he is, so much the better for himself and all connected with him. But it would be nonsense to pretend that possession of all the virtues, and the gift of address in the practical work of life, are the same thing.

These openings for the co-operation of workmen in the task of administration which is to increase efficiency, are perhaps of more value to many men than the provision of an opportunity for putting by a little windfall of money. For they may preserve alive in some, and revive in others, the sense of personal importance which is so effective in keeping men straight and out of the mud. If he is a good worker who saves £5 a year, what is to be said of him who helps to increase output by so much, and more? The wage-earner is to be lifted out of his groove by enabling him to become a partner in the business, according to Mr. Livesey's plan. This is quite right and good; but the individual profit-sharer's conscious sense of desert in this regard is scarcely strong enough to keep his heart in his work all the time. The encouragement of genius, of talent, and of average smartness, is equally worth doing; and the assisted man feels it immediately. It is another way of achieving the elevation of wage-earners. We do, on the other hand, unreservedly endorse Mr. Livesey's observation that high wages and good bonuses paid away to the average workman do him no lasting good. It is all very well for Mr. Rowan to say that the workpeople in the Cleveland district are as well able to benefit by any increase in their earnings as any gentleman attending the Engineering Congress. There will be a few of whom so much can be said; but it is not the general experience. Against Mr. Rowan may be set the Chairman of Palmer's Shipbuilding Company, who stated recently that the firm's workmen scarcely average half the possible working time; their earnings for the time they work being sufficient for all their needs. These men are the true rich; for they really have more than they want. What is the wealth of a mere millionaire, followed wherever he goes by the care of his investments or of his gold and precious stones, to the complete independence of a shipwright who can go to any football match in the kingdom without thought for the morrow? Truly, it is not the poverty of the British workman, but his wealth, which endangers the continued prosperity of the industrial community.

There is no "moral." All that has been advanced here is only designed to show that the problem of the Remuneration of Labour involves many factors, and is not susceptible of a general solution.

CHEMICAL INSTRUCTION AND THE CHEMICAL INDUSTRIES IN GERMANY.

In a previous article,* we have given some particulars taken from the report of Dr. Rose to the Foreign Office as to the application of chemical science in Germany to the practical purposes of enriching the soil by means of artificial manures, and of replacing and supplementing natural with artificial dyes—thereby vastly increasing the wealth of the German nation and, consequently, of those nations with whom she trades. The latter is an economic consequence often forgotten—if ever understood—by those good people who are always trying to frighten us with the bogey of the increased prosperity of foreign countries. There are several other important fields of industry in Germany wherein chemical science has rendered valuable assistance, as to which particulars are given by Dr. Rose. These we will now briefly notice. No account of the triumphs of chemical research in

Ante, p. 894.

Germany would be complete which did not refer to the invention of the incandescent system of gas lighting, and to the growth of the acetylene lighting industry. Upon these points, the report of Dr. Rose is not very full. He says:—

Illuminating industries have latterly profited greatly by chemical research, and have been thereby enabled to compete most successfully with the spread of electric lighting. Of immense importance was the invention by Auer von Welsbach of the incandescent mantle for the non-luminous flame of coal gas, which opened up a new future to coal-gas lighting, and gave this industry a fresh lease of life. The fundamental principle involved in his invention was by no means novel, as chemists have known for years that certain incombustible bodies, when subjected to great heat, give forth this heat as light. For example, burnt lime and platinum wire. Welsbach's great service consisted in the application of the oxides of rare metals for this purpose in the form of a skeleton ash-mantle. At first, oxides of zirconium, lanthanum, and cerium were used, until it was found that the oxide of thorium, with a small admixture of the oxide of cerium, was most suitable. The raw material (nitrate of thorium) came at first from Norway; but soon large quantities of a suitable thorium salt were found in monazite sand in Brazil and the United States. The price of nitrate of thorium consequently sank from £40 per pound in 1894 to about 17s. at the present day. About the same time, Moissau, in France, and Willson, in America, showed how calcium carbide could be produced cheaply and on a large scale from limestone and coke in the great heat of the electric furnace; and thus laid the foundation of the acetylene lighting industry. Germany at once profited by the opportunity, and easily attained the first rank in acetylene gas lighting. Up to the middle of 1900, about 10,000-horse power, with a capital of about £350,000, were devoted in Germany to the production of carbide of calcium; and German capital went largely abroad for the same purpose. At present, there is a grave crisis caused by over-production in the carbide industry; and prices since 1898 have declined about one-half. Acetylene gas lighting has meanwhile made rapid strides, and over 420,000 jets are at present installed and about 36 small towns lighted exclusively by this new illuminant. A signal success of acetylene was the adoption of the acetylene oil-gas system of lighting railway carriages by the Prussian and the German State Railways.

Another branch of chemical industry that has made considerable strides during the past ten years is the supply of various gases in a compressed and liquefied condition. Compressed hydrogen and oxygen can now be obtained at very moderate prices; while ammonia, sulphurous acid, chlorine, and carbonic acid are sold in large quantities in a liquefied state. Liquid acetylene is also sold; but only for scientific purposes, and by special permission. These chemicals are sold in strong, specially constructed, steel flasks of various capacities, which are previously tested by subjection to a pressure far in excess of that which they will be afterwards required to bear. It will give some idea of the extent of this industry if it is stated that one Würtemberg carbonic acid firm, with a capital of £100,000, possess no less than 30,000 of these steel flasks. Sulphurous acid and carbonic acid are required for industrial purposes in such large and increasing quantities that, in order to save the carriage of the steel flasks, they are now forwarded to their destination in extremely strong iron tanks of 10 tons capacity—the before-mentioned Würtemberg firm, for example, sending tank-waggons of liquefied carbonic acid gas to Zürich, Berlin, and Vienna, at which places the liquefied gas is run into steel flasks for local distribution. About 3000 tons of liquefied carbonic acid gas, valued at £30,000, are exported annually; while the total output, which in 1884 was 122 tons, and in 1891 was 3000 tons, is now about 16,000 tons, of which Berlin alone consumes 1800 tons.

Other industries that owe their origin to chemical research are: The manufacture of artificial perfumes; of chloral, chloroform (discovered by Liebig in 1831), antipyrine, and other pharmaceutical products (Germany produces about 70 per cent. of the world's consumption of quinine); of explosives (guncotton was discovered in 1846 by both Schönbein and Böttger, and nitroglycerine in 1847 by Sobrero); of cellulose for the manufacture of paper; and many others. The temporary prohibition of the export of carbolic acid from the United Kingdom at the commencement of the South African War, led to the creation of a new branch of chemical industry in Germany. The annual consumption of pure phenol in that country is about 2000 tons, of which only 10 per cent. is used for the manufacture of picric acid. As Germany does not derive any appreciable amount of phenol from the home production of coal tar, her requirements are principally obtained from crude carbolic acid imported from the United Kingdom; Germany buying from us annually about 900,000 gallons of carbolic acid and less pure phenol. The prohibition of the export of carbolic from this country, in January, 1900, sent up the price of crystallic carbolic acid in Germany from £7 to £12 per 2 cwt. As is well known, it is possible to produce phenol synthetically from benzol—for which product Germany is not dependent on imports from the United Kingdom. But formerly the process had been too costly to enable phenol obtained by synthesis to compete commercially with that prepared from crude British carbolic acid. The high prices caused by the prohibition referred to, however, and the low price of benzol, were instrumental in giving a great impetus to the endeavours of German chemists to discover a cheap working method of preparing phenol synthetically from benzol, and so render Germany less dependent upon imports from Great Britain.

A beginning was made in February, 1900; and 20 tons of synthetic phenol were made and immediately sold by the chemical works at Höchst-on-the-Main. Two processes are chiefly used; the cost of production being about the same in both cases. One is from benzol sulphonic acid, by means of caustic potash or soda; the other from amido-benzol (aniline), by means of nitrous acid. Other works at once commenced the erection of plant for the manufacture of phenol; and even after the prohibition of the export of carbolic acid from this country was cancelled, the high price of carbolic acid, and the low price of benzol, still rendered, in some cases, the synthetic process profitable. It will be interesting to see whether that process will be so much further cheapened as to oust the British carbolic acid from the German market. It must not, however, be forgotten that that event would certainly result in a considerable lifting of benzol prices.

As Dr. Rose observes in conclusion, a careful perusal of his report sufficiently demonstrates the fact that the sums expended by the German States upon chemical instruction have been amply repaid by the creation and rapid growth of many most important chemical industries, and the addition of large sums to the total of the nation's wealth. Germany has been enabled, by means of the thorough chemical instruction afforded by her universities and technical high schools, and the sound preliminary scholastic education of her students, to rise, within the last fifty years, to the front rank in chemical industries, and not only to render herself independent of many imports from foreign countries, but also to deprive the latter of many lucrative branches of chemical manufacture, and to substitute her own in their stead. Moreover, having attained the highest position in the world in chemical industries, she is not abating her efforts, content with the measure of reward which has fallen to her share. On the contrary, it is universally recognized by her people that the efforts hitherto made must be increased, and more carefully and judiciously applied, if the German chemical industries are to maintain and strengthen their position in the future.

Has this country, has the gas industry, nothing to learn from a consideration of the past successes, the present position, and the future prospects of chemical research in Germany? Have we done, and are we still doing, everything possible to maintain and improve our commercial position by patient and indefatigable study and investigation, or have we trusted, and are we trusting, in too great a degree to the favour of fortune?

ELECTRIC LIGHTING MEMORANDA.

Sheffield Corporation Finance—A Bad Case—More Capital Needed for Electric Lighting—A Day of Reckoning to Come.

Partisans of the "principle" of Municipalism, as a rule for ensuring the efficient and satisfactory rendering of certain public services, will soon find themselves confronted with an embarrassing pile of examples proving that concrete performances do not always bear out abstract expectations. Municipal electric lighting is one of the things which Parliament and public opinion have agreed to encourage; but apparently more than one prominent municipal corporation is bent upon showing that electricity supply is the last straw that breaks down the fragile system of local government finance. We lately had occasion to cite the case of Plymouth, as an example of time-serving municipal finance. Now it transpires that Sheffield is in the same box. A copy of a local newspaper that has just come to hand bears the heading "Sheffield City Council," followed by the legend "Serious Financial Position." Investigation shows that this superscription refers to a resolution moved at the last City Council meeting by Alderman Franklin, to the effect that an authorized application to the Local Government Board for sanction to two loans, of £83,237 and £416,762 respectively, be not further proceeded with till the Finance Committee had been consulted on the matter. The resolution was eventually carried.

The question arose in this way: Since 1895, the spending committees of the City Council have reported their requirements to the Finance Committee, who undertook to provide them with capital. The Water Committee, however, were excepted from this rule, as they had their own statutory financial resources. When the Tramways and the Electricity Supply undertakings passed under Corporation control, and had Committees assigned to them, these bodies assumed the same freedom from financial control that was enjoyed by the Water Committee—apparently on the ground of their being "revenue-earning departments." This assertion of a fundamental difference between the so-called "remunerative," and "unremunerative" departments of the Corporation finances, is exactly of a piece with the ideas of Municipal Progressivism; but unfortunately it does not accord with sound principles of municipal finance, nor always correspond with the facts. It is a leading feature of municipal "remunerative" undertakings to be occasionally unremunerative; and often this is their permanent condition. There are many places where corporation water supply, tramways, and electric lighting are burdens upon the rates, without much prospect of ever becoming anything else; yet in Progressive politics these undertakings are always classified as reproductive enterprises.

In the experience of Sheffield, the quasi-independence of the revenue-earning—they do not call them profitable—departments in respect of capital outlay has become intolerable and unsafe. Alderman Franklin, as Chairman of the Finance Committee of the Corporation, does not desire to exercise any control over the general policy of the departments in question; but he and his Committee feel strongly on the point that, while they are responsible for the finances of the Corporation as a whole, and have to

find the money for all these capital undertakings, they are not consulted as to when or how the money is to be found for them. The Electric Light Committee, for example, demanded another half-million sterling, to be raised in the statutory manner. But while preferring this demand, they neglected to inform the Council that they had already overdrawn their banking account by some £111,000, without a tittle of authority. Naturally, when these transactions came to the knowledge of those who are charged with the responsibility for maintaining the credit of the City, they grew restive under the disclosure. As we remarked in connection with the Plymouth case, debt is debt; and when the resources of a Municipality are pledged with money-lenders, the distinction between what is advanced on revenue-earning undertakings and what is sunk irredeemably does not really amount to much of a difference.

Alderman Styring, of the Electric Light Committee, was not at all disposed to accept the policy recommended by his brother alderman who holds the purse-strings. He declared, on the contrary, that, whether the Finance Committee like it or not, the money necessary to work and develop the statutory undertakings of the Corporation must be forthcoming. This is a hard saying; and the truth, such as it is, ought not to have been so expressed. To hold a pistol at the head of a Corporation Committee in this manner, and order it to "stand and deliver," is not the proper way to develop corporation undertakings. In such circumstances, more than one councilman who might in the ordinary way look favourably upon the extension of municipal trading ventures, would reconsider the position. For it is not true, it is not by any means true, that a corporation is in duty bound to find all the money demanded for their own purposes by a particular committee. The work of all committees must be coordinated, and subordinated, to the common good; and if the corporation cannot afford anything, that is sufficient reason for its being dispensed with. Curiously enough, the Alderman who so passionately pleaded for the financial independence of the Electric Lighting Committee, explained their heavy bank overdraft as having been due to pressure that had been brought upon them by the Finance Committee "to put their house in order." It is to be feared that a good many local authorities' electric lighting accounts want a similar straightening out.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 983.)

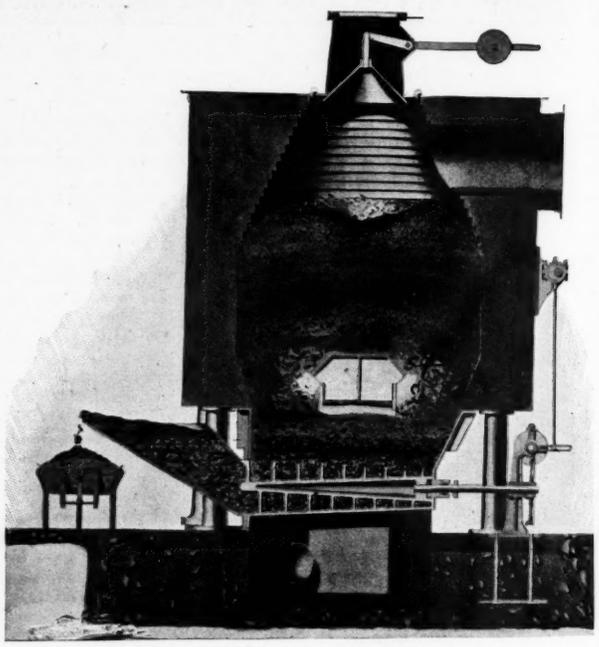
THE aspect of things on the Stock Exchange was somewhat parti-coloured. Happily, however, though they opened rather black, the prospect was more rosy at the finish. The death of the Ameer in the East, and the flatness of Wall Street in the West, were the early depressing influences; but a quick change in the latter market, and the fact of the Local Loans issue being well taken up, soon brought about the desired improvement. The Settlement, too, gave rise to no difficulties; and that helped the cheerful tone. In the Money Market, there was an extremely abundant supply, and all requirements, ordinary and extraordinary, were easily met. Business in the Gas Market was no better than moderate on the whole, and the fair promise at the opening that active movements might be expected was not realized. However, transactions were rather more evenly distributed about the list, and not confined mostly to one or two leading stocks, as has recently been the case. The general tendency was easier; there being something of a reaction from the higher prices lately ruling. This is an ordinary phenomenon, and need in no way disturb the minds of believers in the general improvements of Gas Stock prices. In Gaslight and Coke issues, the ordinary showed a weaker disposition from the start; and was marked at 98 on Monday. This figure was repeated every day; and though 97 was touched once or twice, there was no sign at the close of a further fall. A fair amount of business was done in the secured issues, and prices were good, aided no doubt by the general demand existing for this class of security. South Metropolitan was more dealt in, and showed weakness at first, being done as low as 124; but, by the close, prices came out better, and the last mark was 126. In Commercials, a couple of bargains were done "specially" at easy figures, which had a weakening effect. The old stock was quoted a point easier; but the new was fractionally higher. The Suburban and Provincial group presented no feature of note in the London market; but locally Liverpool was put down a little. In the Continental Companies, business was limited; but prices were very fair, without any variation. Among remoter undertakings, Buenos Ayres debenture rose. Dealings in Water were more active, and the recent sharp rises in value were well sustained, and, in a few instances, augmented.

The daily operations were: Fairly brisk business in Gaslight ordinary and South Metropolitan on Monday; but nothing else was touched. Quotations were unchanged. In Water, Chelsea debenture rose 2. On Tuesday, operations in Gas were lighter, but more widely distributed. Gaslight ordinary fell 1; and South Metropolitan 1½. Wednesday was a quiet day for Gas. In Water, both Southwarks rose 2. On Thursday, Gas was very quiet, and quotations did not move. In Water, Chelsea and Southwark gained 2. Gas was a little more active on Friday. Buenos Ayres debenture moved up 1½, and several issues were marked *ex div.* In Water, Southwark "D" rose 2. Saturday was moderately brisk. All quotations closed unchanged.

WILSON'S GAS MOTIVE-POWER PLANT.

RECENT events having brought into prominence the subject of fuel-gas production, and the character and merits of the Mond and Duff specialities in this line having been adequately set forth to the industrial public, it will be useful to place upon record the present condition of fuel-gas practice according to other systems. It may be as well to recapitulate the special points of the Mond-Duff variety of fuel gas, which forms a class by itself. Though the gaseous product itself is only a 150-unit fuel gas, like another, it differs from all others in the source of this calorific power. This is chiefly hydrogen, resulting from the decomposition in the producer fire of a large quantity of water. The first and principal object of passing so large a quantity of water through the fire is, as is well known, to wash out of the fuel as much as possible of the ammonia. In order to effect this object, also, a low furnace temperature is desirable. It is further necessary, for the gasification of the large quantity of water, that a very complete arrangement for returning to the producer the sensible heat carried off by its products should be provided. But for this high efficiency of recuperation, the excess of moisture would put out the fire. Mond-Duff gas is consequently a product of a low-temperature process of gasification, with excess of water. It contains a very high proportion of the incombustible chimney gases, nitrogen and carbonic acid; and it can only be advantageously made where the coal used is rich in ammonia, recoverable in a marketable form, and where water is plentiful.

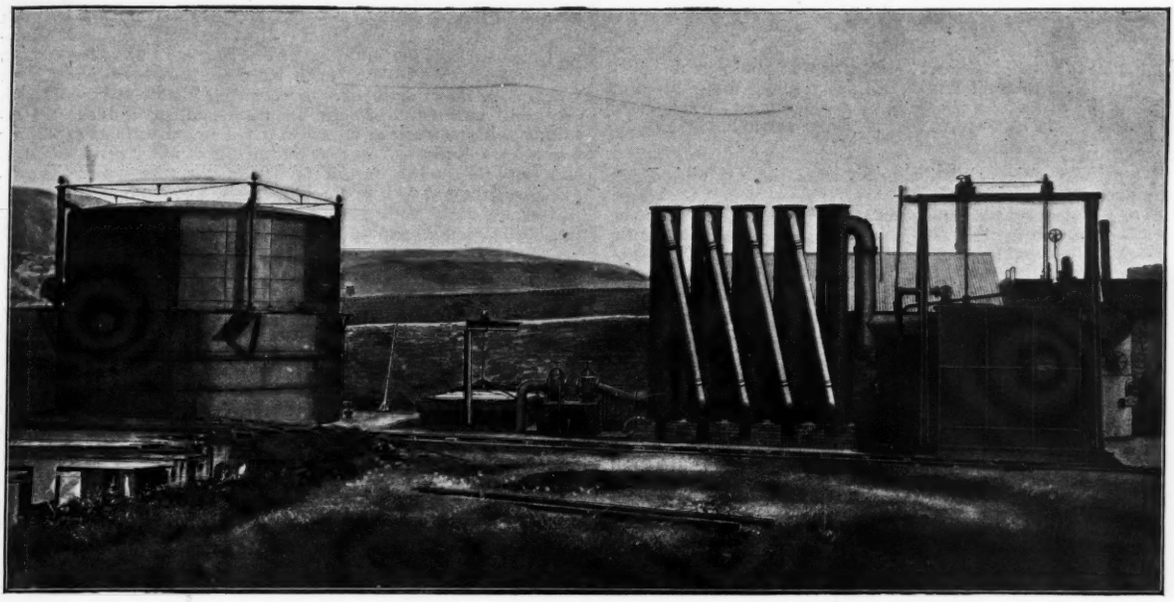
Other systems of fuel-gas making all belong, without exception, to the high-temperature class of producers; and some differ so



THE WILSON GAS-PRODUCER.

widely from the Mond-Duff principle as to use no water whatever. The latest Lencauchez plants work with a fan blast, which is a far more economical means of forcing combustion than a steam-jet. The product is a gaseous fuel rich in carbonic oxide, but with no hydrogen. It appears to be easily made from the lowest grades of the poor, dry-natured coals of the Continent of Europe. One would expect that compressed peat and wood might be amenable to treatment in the same way. The system has its limitations, however, in the practical impossibility of working a strong coal by forced draught, in any depth, without choking the furnace with clinker. Steam was added to the original gas-generator furnaces with the double object of reducing the excessive local temperature, and keeping the clinker in a state that made it convenient for removal. The hotter the Siemens type of producer can be worked, the more economical it is as a gas generator, and the better gas it makes.

Many engineers have remained faithful to the high-temperature class of gas-producer, for various reasons. Prominent among these is Mr. Alfred Wilson, of Stafford, whose producers have been favourably known to fuel-users these many years past. Mr. Wilson, however, has felt the full force of the revolution that has occurred in connection with the large gas-engine; and he now announces his "Gas Motive-Power Plant" as confidently as any. This arrangement is a perfectly natural development of the Wilson producer, as originally made for heating kilns, &c. The producer itself is practically unaltered in shape. It is still made to contain a deep mass of fuel, and the depth of the fuel-bed has nothing to do with the composition of the gas made. This differentiates the type from the Dellwik and other systems in which the thickness of the fuel-bed has a critical value. The



THE WILSON GAS-POWER PLANT AT THE HORSEHAY WORKS, SHROPSHIRE.

Wilson producer has, however, been improved in several important details. The early ones had to be stopped for a considerable period once a day for clinkering, which meant loss of time and of fuel. For twelve years past, a mechanical continuous-acting clinkering attachment has been applied to the Wilson producer, consisting of an endless screw working in the mass of clinker and ashes lying in the water ash-pan underneath the hearth. This forces the refuse up an inclined plane outside the producer, whence it drops into trucks or upon a conveyor as the case may be. These worms are made tapering; their largest diameter being at the outside end; and the blades increase in pitch in the same direction. Consequently, nothing sticks in them. The wear and tear of these arrangements is very small; and, owing to the continual agitation of the fuel by the moving worm, the best condition for a uniform production of gas is secured.

During the many years of the successful application of Dowson power-gas plant, using always either anthracite coal or coke for driving gas-engines of small and moderate sizes, Mr. Wilson appears not to have seen his way to enter this field with his gas-producers consuming bituminous slack coal. The reason for this abstention was the small size of the power units, which offered no scope for the elaborate purifying plant necessary in the case of bituminous coal gas. It cannot be too strongly insisted upon that Dowson and other simple gas-producers, with little or no provision for purifying the gas in any way, are only really satisfactory with the cleanest anthracite; and this is now preferred for their consumption in the grade of "pea anthracite." Gas coke is apt to be too dirty for these plants; and, of course, metallurgical coke is too scarce and dear.

This being the case, the economical aspect of power generation by means of fuel gas was evidently tied to the cost and availability of anthracite. Even so, its cost just equalled that of power generated by the best modern steam-engines and boilers; while it was, on the whole, more convenient than the latter. With the enlargement of gas-engines, and the heightened appreciation of the advantages of power distribution in factories, which are marks of modern engineering opinion, came the opportunity for adapting to this new demand the much cheaper fuel gas which can be made from bituminous slack coal at only one-third the price of anthracite and one-half the cost of coke. This gas has to be purified; and though the purifying process might even be profitable, on account of the value of some of the matters classed as impurities when they occur where they are not wanted, it could not be properly done on a very small scale.

Obviously, the question of whether or not purification of fuel gas made from bituminous coal pays for itself, is subsidiary to that of whether such gas, residuals apart, can be advantageously used by proper treatment for the purpose in view—namely, the generation by means of gas-engines of power on a larger scale than that of the familiar Dowson plant. This major problem was solved experimentally by Mr. Wilson, with four years' continuous working of a 150-horse Crossley engine. In the light of the experience gained from this trial, a gas-power plant of considerable importance was designed by Mr. Wilson for the Horsehay Company, Limited, Shropshire, where it has been erected by the Company. The accompanying illustration represents this plant as it stands, having a gas-producing capacity equal to about 300 indicated horse power. It consists of one Wilson gas-producer with heat regenerator, gas cooling and washing appliances, and a gasholder about 25 feet in diameter. By a system of underground cast-iron mains, the gas is distributed from the holder to various engines scattered over the extensive works. Two of the engines, including the largest, of 80-horse power, are by the Stockport Company, the others being Crossley's.

The coal is brought by rail to the charging-stage level of the producer; thus saving this labour. The producer is blown by a small Root's blower; but before entering the producer, the air, along with a certain volume of added waste steam, passes through the cast-iron pipe regenerator which in the picture stands on the right and nearly hides the producer. The gas issues from the latter at a temperature of 800° to 1000° Fahr., and by means of this piece of apparatus much of this sensible heat is transferred to the air and steam. Between the producer and the regenerator is an automatic check, so that while air can always go forward, gas can never return. Thus the formation of an explosive mixture when the producer is stopped is prevented. The gas is next passed through an annular air surface condenser (shown in the picture) where it is reduced to atmospheric temperature. It then passes through a washer, and finally through a sawdust check-box into the gasholder. There are the usual tar and liquor drain pipes, seals, and wells. One man attends to the producer and the whole of the plant. Very little water is used; the object being to avoid loading the gas with aqueous vapour.

In continuous working, the power generated in this kind of plant is remarkably cheap. The fuel consumption works out to about 1 lb. of slack coal per indicated horse power per hour. With coal at 7s. 6d. per ton, labour, capital charges, water, and stores, the cost is 10s. per ton of coal gasified, representing 2000 indicated horse-power-hours, or 0·06d. per I.H.P. hour.

The gas shows a calorific power of from 140 to 150 British thermal units per cubic foot. The system was installed under the careful supervision of Mr. H. C. Simpson, Managing-Director of the Horsehay Company, who decided in favour of this method of power generation and distribution after a very thorough consideration of its merits as compared with central station electricity generation, and electric motors in the various shops. Small gas-engines are almost as efficient as large ones; and there is no loss through pipe distribution. Thus the loss of efficiency by the double electric transformation through dynamo and motor is saved. The separate gas-engines cost about the same as separate electric motors; so that there is nothing to gain or lose in this way. Inasmuch as the Horsehay Company, who are large iron and steel bridge builders, have on their works electric power and light, hydraulic power, pneumatic power, and now possess a very complete system of gas power, they must be credited with knowing as much as is necessary about all these different forms of power; and the fact of their latest advance being an installation of gas power should be regarded as a handsome testimonial to its merit. The only point of weakness we can see in this plan is the amount of ground space occupied by it, which seems considerable. Of course, where there is ample room and to spare, this consideration does not matter; but the plant strikes one as being rather bulky for its power, to say nothing of the accessory boiler, which would be necessary if waste steam were not available. We are indebted to Mr. Wilson for the particulars upon which this article is based.

Among the awards made by the Council of the Institution of Civil Engineers for papers dealt with in the past session are a Watt medal and a Telford premium to Mr. J. Emerson Dowson, who is so well known in connection with the economical production of gas for motive power.

PERSONAL.

In the "JOURNAL" last week, reference was made to the probability of Mr. Alderman MILES, of Bolton, filling the position of Mayor of the town. In response to a request by an influential deputation of his colleagues who recently waited upon him, he consented to be nominated.

At a private meeting of the members of the Arundel Town Council last Tuesday, Alderman CHARLES BARTLETT was chosen by a large majority, to fill the office of Mayor in the ensuing year. Alderman Bartlett is Chairman of the Arundel and Littlehampton Gas Companies, and is closely associated with practically everything connected with the town. Moreover, he has already been Mayor on three occasions—in 1885, 1888, and 1892.

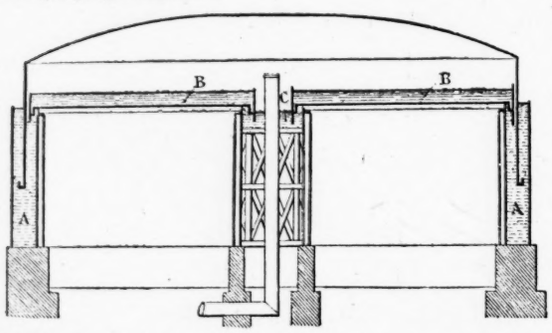
The marriage of Mr. ARTHUR G. GLASGOW to MARGARET ELISABETH, the daughter of Mr. J. Patteson Branch, was solemnized at St. Paul's Church, Richmond, Va., on the 1st inst. As the partner representing the firm of Messrs. Humphreys and Glasgow in this country, Mr. Glasgow has become known, and has made numerous friends among British and Continental gas engineers, on whose behalf as well as our own we tender to him and to Mrs. Glasgow the heartiest congratulations, accompanied by the best wishes for their health and happiness.

On Monday evening last week, the Norwich staff of the British Gaslight Company entertained Mr. JOHN YOUNG at a farewell dinner at the Maid's Head Hotel, prior to his departure for Hull. The chair was taken by Mr. C. G. Frost, the Chief Clerk, to whom was entrusted the toast of the evening, "The Health of Mr. John Young." He expressed the great regret they all felt at losing so worthy a chief, and trusted he would do well in the more responsible position he was about to fill. Mr. Young, in replying, thanked the staff for their kind expressions, and said it had always been a pleasure to him to work with so willing a body of officials. He should always look back with kindly memories to his sojourn amongst them. Among the other toasts were "The New Chief, Mr. Glover," proposed by Mr. Philip Moon, Assistant Engineer and Manager. Mr. Young, in referring to the latter toast, said that in Mr. Glover they would find an exceedingly capable Engineer, who held a very high place in the esteem of his colleagues. On the previous Friday, Mr. Young was the recipient of a testimonial from the officials and workmen. It took the form of a silver salver and afternoon tea service, and was accompanied by three silver *souvenirs* for Mr. Young's children, presented by Mr. Moon. In a few well-chosen words, expressive of the good feeling existing between the Manager and the men, Mr. Frost asked Mr. Young to accept the gifts. In responding, Mr. Young took the opportunity of introducing his successor; and the staff were afterwards entertained by these two gentlemen at the Maid's Head Hotel.

NOTES.

A Novel Gasholder Tank.

A recent number of the "Journal des Usines à Gaz" contained a brief description of an unusual form of gasholder tank, devised and patented by MM. Nebel and Hentze. It is shown in the accompanying illustration.



It will be seen that inside the bell there are constructed a flooring B, furnished with rims, forming a basin on the upper part, and dipping on one side into the water contained in the outer portion of the tank A, into which the lower part of the bell enters, and on the other into the portion (also filled with water) surrounding the gas inlet-pipe C. The flooring is hollow, and the rims rest upon pillars. The water is kept in equilibrium by the pressure of the air outside and the gas inside the bell.

Tests of Coking Coal with Pyridine.

According to a statement of T. Baker, appearing in the "Transactions of the North of England Institution of Mining and Mechanical Engineers," experiments have been made to determine the solvent action of pyridine on certain samples of coal, with the object, apparently, of ascertaining whether a key to the mystery of coking resides in this method of treatment. The author used that portion of the pyridine bases from coal tar which boils at between 110° and 120° C., on samples of coal from the Hutton and Brockwell seams, Durham; anthracite from Yniscedwyn Colliery, South Wales; and Taupiri coal from New Zealand. In every case, 5 grains of finely-divided coal were steeped for fifty hours with 250 cubic centimetres of pyridine in a Soxhlet apparatus. The resultant solution was red to brown in colour, sometimes exhibiting a rich green fluorescence, and was distilled under reduced pressure until the greater part of the pyridine was removed. The residue was treated with hydrochloric acid to precipitate dissolved matter, the mixture filtered, and the precipitate washed several times with water acidulated with hydrochloric acid, finally with water, and then dried at 100° C. The residue from the extraction was dried, to free it as far as possible from pyridine, then washed with water, and dried at 100° C. The results were such as to indicate that the coal from the Hutton seam lost 20·4 per cent. by extraction, the Brockwell coal lost 11·5 per cent., and the anthracite no appreciable amount. The New Zealand coal lost 5·65 per cent. The Hutton coal yields a caked but friable coke. Its extract is extremely rich in volatile matter, and yields a very highly intumescent coke. The residue has lost all the coking properties of the original coal. The Brockwell coal gives a moderately compact coke. Its extract is very rich in volatile matter, and yields a very intumescent coke. The residue retains the coking properties of the original coal to a small extent; but the bulk of the coke is considerably reduced. The New Zealand coal yields a pulverulent coke. Its extract is similar to that of the Durham coals. The residue does not coke.

The Most Economical Forms of Light.

Two remarkable kinds of light, which seem to be produced without appreciable waste of the substance exhibiting the luminosity, are what is called "triboluminescence" and the radiation from the element "radium." The former is the name applied to the property possessed by certain crystalline bodies of emitting a peculiar light, like phosphorescence, when rubbed or struck. This light is, however, not at all like the phenomenon produced by phosphorus, either in the dead or the living body. It was probably first noticed in connection with the handling or heaping of crystallized sugar. Sugar candy or broken lump sugar exhibits this light in a high degree; and so does tartaric acid and uranium nitrate. L. Tschugaeff has investigated the phenomenon in relation to 510 various substances, by grinding in a glass mortar in an absolutely dark room. The result was an arbitrary scale, in which the triboluminescence of uranium nitrate stands first, tartaric acid second, and ammonium oxalate third. Out of 400 organic bodies examined, 121 were found to possess the property; while of 110 inorganic substances, only six were similarly active. The colour of the light varies with different substances; and in most instances it only lasts as long as mechanical work is applied. In some cases, however, there is a gradually disappearing afterflow. As regards the element radium, it is explained that about one ton of the uranium minerals, with the expenditure of six tons of reagents and fifty tons of washing water, yields about ½ oz. of radium. The luminescence of this scarce article is attributed to the continuous emission of electrified particles. The charge carried by these particles is enormous; yet their mass is so small that the waste of the substance is not noticeable.

Energy of Solar Radiation.

Mr. J. Y. Buchanan has discussed, in "Nature," the question of the quantitative determination of the solar radiation which actually reaches the earth's surface. He remarks that the subject is of more than scientific interest. Solar radiation is the source of all the energy which maintains the economy of our globe. It lights and heats the other members of the planetary system; but after all only an infinitesimal proportion of the total radiation has been used. The remainder, so far as we know, is wasted by uninterrupted dissipation into space. In terrestrial physics everything may be said to depend on the energy which, in one form or other, is supplied by the sun's rays. It is the revenue of the world; and it is of fundamental importance for us to know at what rate it falls to be received. We have no practical concern with the quantity which is lost. All that we need care to know is the amount which arrives; and after this how it is utilized. It is certain, for one thing, that the heat of the sun does not accumulate on the earth, or it would soon become uninhabitable. Long ago the earth arrived at a state of equilibrium in this respect, which is maintained year by year, with slight oscillations. The fundamental principle of this state of equilibrium is that the heat which the whole earth receives from the sun in the course of a year leaves it again during the year; so that, taking one year with another, the sum of the heat remains the same. This heat is being received, during part of the year; it is dissipated all through the year. A practical question that arises from this is, how much heat comes per unit of surface during a unit of effective time? Mr. Buchanan has experimentally ascertained this by tests made in Egypt with a sun boiler. He obtained evaporation at the rate of 1-horse power per square metre of exposed surface per minute. It may possibly be a little more, but not very much—say, 1·17-horse power per square metre at the outside. This is the motive power that maintains the temperature of the land and sea, which supplies the energy for all the movements of the ocean, for warming and expanding the air, for furnishing the latent heat represented by the aqueous vapour in the atmosphere, and for stirring up winds and torms.

COMMUNICATED ARTICLES.

LEWIS THOMPSON AND THE EARLY DAYS OF GAS LIGHTING.

By W. J. Warner.

The title of these articles, though apparently wide, limits their scope to the most active period of the professional life of this distinguished Chemist in the science of gas lighting. Reference has been made to this period as one of transition; but it may also be considered as one of consolidation. The gas agitation and its rival schemes were almost immediately followed by amalgamation. The change from the wax candle, which had been taken as a "standard," but which from "the arrangement of the wick can never be uniform for a single minute," to the sperm candle of 120 grains as the standard, was accepted by the only Official Referee (Dr. Letheby). The mode of testing was also fixed, in opposition to what was advanced by a technical paper of the period: "We shall merely surround our photometer with a curtain of unbleached linen." The result, assisted probably by this statement, was the employment by the Official Referee of a method, contrived by Mr. Lewis Thompson, of shutting "out from the photometer all the rays of light but those proceeding directly from the illuminating agents." Then, again, as to the amount of the only impurity which must remain in the gas. There was then the means of testing—Wright's instrument for testing the presence of bisulphuret of carbon—in the completion of which there were services rendered by Lewis Thompson. To turn to the manufacture, there is much to be observed of the same character. High and low heats were resolved into the adoption of the clay retort. Notwithstanding all that had been done with the oxides, it was held, and still holds good, that without lime there can be no thorough purification. Of meters, it may be said that they had superseded then the contract system, though Rutter wrote, in 1849, that "the time is not distant that meters will be universally adopted." And though the relative advantages of the wet and dry was a matter that had still to be discussed, yet the dry meter had taken a firm position in the commercial department of gas lighting; the two-diaphragm meter having been made a practical instrument by Mr. Richards, though the way was led by the most beautiful piece of mechanism in the whole range of gas lighting—the dry meter of Defries and Taylor. Once more, the application of gas to domestic purposes had taken a firm position as a practical source of heat, instead of possessing merely the vague and undefined character of a means for applying and developing it; and doubt was no longer entertained as to the suitability of gas appliances, or the economy of gaseous fuel.

"Hints to Gas Consumers" is the title of a little book published by Parker in 1838. We learn from it the position of gas heating and cooking at this time. It appears not to have occupied a very important place, or to have had much attention given to it. Indeed, it may be said to be only incidentally mentioned, from the following passage:—

> This reminds us that, under proper management, gas may be conveniently employed as a substitute for common fires in warming shops, offices, and public buildings. . . . Gas is also economically used in many places for cooking; some ingenious apparatus having been constructed for that purpose.

There is, however, a longer note in the appendix, which confirms this view:—

> But the superiority of gas as a light-giving agent seems to have absorbed the undivided energies of those interested in its success; and it is only during the last few years that anything has been done (and that has been chiefly by *amateurs*) towards extending its usefulness beyond that sphere which, by universal consent, it occupies without a rival.

A few years later, the position was entirely changed. Gas heating and cooking had become a practical business; and that, too, through the agency of those of whom it has so often been said that they have done little or nothing to advance the use of gas—the gas companies themselves. On Feb. 12, 1850, the Chartered Gas Company issued a circular, from which the following are extracts:—

> The Directors beg to call your attention to the great advantages to be derived by the use of gas for the purpose of cooking, and also for warming halls, apartments, &c. The principal advantages in cooking by gas are, economy (especially since the reduction in the price of gas), cleanliness, and also that great desideratum of having the meat, &c., well done. . . . Whether you have to cook a large joint or a single chop, by merely turning a tap the fire is ready at once, and in its full vigour, and remains so until the meat is cooked, when the gas is immediately turned off, and the fire is out. How different this from the old plan! . . . Poultry, game, pastry of all sorts, are cooked most beautifully by gas. . . . There is no heat or offensive smell. . . . The Directors, therefore, with a desire to encourage the use of gas for the purposes of cooking, &c., have caused several cooking apparatus to be fixed at their station at Horseferry Road, and will be glad by your paying a visit there, when every explanation will be given concerning them.

The same course was pursued a few months later by the Bristol Gas Company—

> To furnish information with regard to fittings, cooking apparatus, &c. . . . Amongst the numerous applications of scientific knowledge to the practical purposes for modern society, there are, perhaps, few more conducive to its comfort and benefit than the introduction of gas as a means of artificial light. . . . Its utility and economy for domestic purposes have not, however, been duly appreciated. . . . Gas cannot be excelled in comfort, utility, or economy. . . . It is equally applicable and economical for most purposes where a uniform and steady heat is necessary; being more manageable than any other mode of heating now in use. For cooking, it is invaluable. . . . In many processes of the arts and manufactures . . . it is much used . . . in Birmingham and other manufacturing towns.

To return to the circular of the Chartered Company. There are several copies of testimonials given, of which the Directors beg perusal. The originals were addressed to Mr. King, the highly respected and gifted Engineer to the Liverpool Gas Company. The first is from Jeffrey Morrish and Co., Compton House: "It is now about two years since you caused to be fixed our gas cooking apparatus . . . It is scarcely possible to enumerate its advantages. . . . We find the cost to be 3s. 4d. per day, average, for about 120 persons." The second is from H. Woolwright, Bold Street: "Having now made use of the gas cooking apparatus and bread oven furnished by the Gas Company under your direction, during the past nine months, I feel desirous of making known to you my satisfaction in the complete success of the undertaking." The last is from Morrish and Feeney, Merchants' Dining Rooms: "We have thought it due to you, and the Gas Company under your directions, thus to express our appreciation of the results of our experiments; and if we were again to open a similar (the daily average of dinners being 800) or larger establishment than the present, we would most certainly adopt your mode of cooking by gas."

As the earliest of these testimonials gives the fixing of the apparatus at Compton House at the beginning of 1848, there must have been considerable progress made both in the designing and the employment of gas cooking-stoves in the ten years from 1838, the date of "Hints to Consumers," to the publication of these testimonials in 1850.

There is an interesting letter in the "Journal" for April, 1851, by Samuel Clegg, jun., under the title of "Gas Cooking-Stoves":

> In the "Expositor" of last week, I saw a portrait of Mr. Sharp, the Manager of the Southampton Gas-Works, and an article claiming for him the *invention* of cooking by gas. Now, I do not believe any man living can claim it as his invention. In 1739, Dr. Clayton boiled eggs by a gas-flame; in 1792, Mr. Murdoch frequently cooked chops and steaks over gas-jets; and in 1824 I perfectly well remember the men at the Ætna Iron-Works, near Liverpool, making a gas cooking apparatus, which consisted of a gun barrel turned backwards and forwards, and pierced with numerous small holes. When anything had to be fried, the gridiron was kept in a horizontal position; when anything had to be roasted, it was turned in a vertical position, and a plate of tin was placed behind the meat, as a reflector, or a hastener, as I think the cooks call it. Mr. Sharp may have contrived a stove for cooking by gas—that is, pieces of iron so placed as to hold different things, some, perhaps, requiring to be boiled, others to be fried or roasted; but I believe that Mr. Alfred King, of Liverpool, arranged (I won't call it invented, for it is not worth the name, and I am sure Mr. King will not quarrel with the word) the first convenient apparatus for cooking by gas. Gas cooking-stoves are not yet perfect; but they are already economical, and I hope will very soon be universal.

Mr. Sharp makes no reply to this; but we gather from a letter of his to the "Journal" in May of the same year some further particulars upon the subject. The following is an extract:

> I have placed two apparatus there [the Polytechnic Institution], one designed for a small family, and one which will cook for a very large party. The small one is similar to the one invented by me twenty-five years back, and used by many families with economy when gas was double the price it is at present. We have one in use in my kitchen, which was made in 1828, and from this date has been constantly in use up to the present time, and is as efficient now as in the first year it was used; the only repairs having been to the boiler and gauze-burner.

Of the form and general arrangement of these stoves there appears to be nothing in the "Journal" from 1850. There is an illustrated advertisement of a very large range of ovens by a Liverpool maker—four large chambers put side by side, with large circular openings placed over them in a hot-plate, it is assumed. They were "manufactured on a principle approved by Alfred King, Esq., Engineer of the Liverpool United Gas-Works, and can be had from the manufacturer in every size and variety." In May, 1851, there is a paragraph in the "Journal" from the "Suffolk Chronicle," from which is extracted the following:—

> We have been induced to make these remarks from an opportunity offered us of inspecting a very novel and ingenious apparatus, invented by Mr. Goddard, the Engineer to the Gas Company in this town, and which has now been forwarded to the exhibition of gas apparatus at the Polytechnic Institution. . . . It is in the form of a square pedestal, 15 by 18 inches, with a bold entablature 24 by 24 inches, and is 3 feet high. The roasting, baking, and boiling take place in a well-ventilated chamber lined with porcelain, the non-conducting and reflecting properties of which render this mode of cooking very economical. The boiling, steaming, stewing, or frying can be carried on simultaneously with the roasting, and are performed on the top of the apparatus, which is provided with three coil burners of an ingenious construction. One of these burners is so arranged as to be available for the heating of irons for laundry purposes. The whole apparatus presents a unique, chaste, and compact appearance.

This stove was afterwards known as the "East Anglian Gas Cooking Apparatus," and from its general appearance and arrangement may be considered as the type of the modern stove. There

is a full-page advertisement running through the "JOURNAL," giving copies of testimonials, to one of which there is a most interesting note. The testimonial is from a Mr. Andrews, of Reading, one of a firm of engineers there:—

I have not the slightest hesitation in saying that, when every gas company acts under the same enlightened views taken by your Directors,* gas for the purposes of cooking must supersede every other plan.

Now, as to the gas-fire. The one which was known as "Bachhoffner's Polytechnic Fire" was patented by Dr. Bachhoffner and Defries in December, 1850. It "refers to modes of producing a bright incandescent fire, in imitation of an ordinary fire-place. For this purpose, a grate, somewhat similar to a common fire-grate, is employed; the bottom bars for this purpose being perforated iron tubes for the admission of the gas, as commonly employed in its combustion for the purpose of heating. Or the ordinary bars of a grate may be covered with wire gauze, platinum foil, perforated talc, or iron balls. Beneath this, three or more rings of gas-jets are allowed to discharge, so as to pass through the perforated talc or wire gauze, on the top of which are placed shreds, parings, or thin plates of metal, or the metal platinum in a finely divided state, commonly known as a spongy platina." "One of the great impediments to the employment of gas consisted in the absence of that visible fire which custom has rendered essential to British comfort; but this impediment no longer exists, for most assuredly the 'Polytechnic' fire has all the outward and visible signs of a good cinder fire." This is from a notice of the fire given in the "JOURNAL;" and the writer, who appears to have admired and enjoyed the fire, asked: What does all this cost . . . the cost of the gas as compared with the calorific equivalent in common coal? This was a knotty question. The gas contemplated to be used was what is called water gas, so that the project realizes in this respect the old adage "setting the Thames on fire."

In December, 1852, the following appeared in the "Circular to Gas Companies" in the "JOURNAL": "The 'London Gazette' of the past month has been, as usual at this period of the year, crowded with notices of intended applications to Parliament for new Acts. Among them are rather more than the usual number of notices affecting gas companies; and one of them is of so novel and extensive a character that we give it entire. We understand the promoters are highly respectable and wealthy, and are intending to give the scheme of substituting gas as a heating agent for solid fuel a fair and honest trial, and that arrangements are in progress for an experiment upon a sufficiently extensive scale to determine its comparative cost and economical results." The parliamentary notice is too long to be given here, beyond a statement of the title and most novel objects and powers proposed to be taken:—

Application is intended to be made to Parliament in the next session for an Act to incorporate a Company to be called the Gas-Fire Company, or by such other name as may be deemed expedient for the production of fires and heat by the agency of gas in dwellings and other buildings within England and Wales and Berwick-upon-Tweed . . . to hold lands and houses, and to levy and receive rates, rents, and remunerations, for the production of fires and heat by the agency of gas; to open roads, streets, &c., for the purpose of laying down pipes; to manufacture and supply gas for the purposes aforesaid; and to authorize any corporation or persons, having the right to supply any town or place, to supply gas to the said Company; also to give to the said Company all the powers and privileges mentioned and contained in the Gas-Works Clauses Act.

The Bill was not introduced, and the scheme was abandoned.

"A problem of greater public and domestic importance can scarcely be proposed than to clear the atmosphere of towns from smoke. The sources of smoke may be placed under two heads—manufacturing and domestic. . . . But the great bulk of smoke of all towns flows from the latter source—domestic fires." This is copied from an important and most interesting paper, published in the "JOURNAL" for December, 1853. It is regretted that space will not allow of our giving fuller extracts than those now to be quoted from what is entitled "A Plan for Clearing the Atmosphere of Towns from the Smoke of Domestic Fires," by Julius Jeffreys, Esq., F.R.S., F.G.S. Under this most misleading title, the valuable suggestions therein contained have laid hidden for nearly fifty years. This, however, may be excused, as the object of the paper—the remedy for a smoky atmosphere—was accurately covered by its title. The writer proceeds:—

To consume the smoke of coal burnt in open domestic fires may at once be pronounced impossible in practice. The only remedy is to avoid generating smoke at all, by employing non-fuliginous matter as fuel. It is more than fifteen years since jets of gas were first lighted in a grate, under an open chimney, as a substitute for a common fire; but the attempt was unscientific and practically useless. Gas-flame emits little heat by radiation, compared with that which, in such a case, it sends up the chimney in a combined state. To arrest a portion of this combined heat of gas thus going to waste, by making the flames play upon and excite to incandescence certain incombustible matters, such as asbestos, was an ingenious modification by Mr. Brockedon, and it gave a practical utility to what had been a barren attempt.

Dr. Bachhoffner made a further improvement by demonstrating that a certain other arrangement, which had been long known merely as a philosophical toy—namely, platinum rendered incandescent by gas—admitted of being expanded into the scale of an open fire, and at a cost which may be considered very moderate, when its attractive qualities and many advantages are taken into account. . . . In all these cases, however, it is manifest that the whole of the heat radiated by the fire is ultimately derived from the combustion of gas—the incandescent matters giving out no heat of their own, but heat merely borrowed from the gas currents. . . . Prompted by an object of such importance as the general substitution of smokeless fuel for common coal, it occurred to me that coke, though a sluggish fuel alone, might probably be brought into a state of vivid combustion when urged by jets of gas heating air flowing to it; and that when the coke was ignited the gas required to maintain its combustion might be very small, while the coke would give out so much larger a proportion of its caloric as radiant heat than coal does, that it was possible the cost of the coke and gas united might not exceed that of a coal-fire, having equal effect. In pursuance of the idea, jets of gas were conveyed into the bottom, and horizontally into the front, of an ordinary parlour grate, which was then filled with gas coke. The trial was at once satisfactory. After a few readjustments of the gas-jets, a result has been obtained surpassing that anticipated, and establishing the fact that, by the use of coke at 20s. per ton, and of gas at 4s. per 1000 cubic feet (the current prices of these articles), a greater heating effect may be produced than by an equal outlay on coal.

Then are set forth the several advantages under seven headings, which are followed by the distinctive difference between the two systems.

Instead of the gaseous element being "allowed to fume off wastefully from the upper surface of the coal, carrying away multitudes of its solid particles in the form of smoke. the gaseous matter is previously distilled out of the coal at the gas-works, in the proper state of definite combination, known as coal gas. The separated coke and gas are then conveyed into domestic grates, but the coke is now placed above the gas; the latter, in the form of ignited jets below it and partly in front, heats the cold air and coke just as they meet, and thus facilitates combustion. . . . Half-a-dozen trifling jets of gas issuing from an iron tube with lateral perforations, and commanded by a cock, is all that is required for a poor man's fire. The gas and coke per day need not at most exceed a penny each, and the pipes should be laid on by landlords.

The "Journal of the Society of Arts" says that, one of the officers of the Society has adopted a method somewhat similar to that proposed by Mr. Jeffreys, for the fires of bedrooms, which are required to be lighted on short notice.

In January, 1854, Mr. Jeffreys returned to the subject under the title of "Warmth without Smoke." This communication may be perused with considerable interest, after reading the first article; but the concluding words can only be given—

To accuse either coke or gas of affecting the purity of the atmosphere of the room, is to repeat the very injustice of the wolf which accused the lamb of making the stream impure against the current. All that such a fire can, or does, send into a room, are such of its products as are radiant; and these are heat and light alone.

The baneful influence of Dr. Letheby's report here again appears; and we may assume that the prejudicial effect was being so seriously felt that the Directors of the Chartered Gas Company had to instruct Messrs. Leeson and Warrington to report upon the subject. This report was published, *in extenso*, in the "JOURNAL" for December, 1854, under the title of "On the Salubrity of the Use of Coal Gas." A few extracts from this report will not be devoid of interest. Very properly, these eminent Chemists refer at once to the moral effect of the publication of the results of Dr. Letheby's experiments, and therefore of the necessity for great carefulness in conducting them, and, further, the obligation which he was under to give the details of his working. They say:

In a case involving the character and integrity of the gas companies, the detail of the experiments actually made ought to have been appended to the report, with every information as to the dates, the *modus operandi*, &c. . . . Every scientific observer knows how easily this might have been done, and will be but little inclined to rely on the mere deductions of an experimenter, when the grounds of confidence are thus withheld. . . . We believe that the "bit of vitriol" has been, as already stated, *manufactured* from the gas—not produced by the ordinary method of combustion, but by a peculiar process adopted for these experiments; and we have reason to doubt, in the absence of any specific evidence to the contrary, whether all the acid produced was sulphuric acid. . . . Having thus, we trust, shown the comparative minor importance of Dr. Letheby's alarms, we would not for one moment hinder the adoption of any means by which the benefits of gas may be further extended and improved; but, instead of decrying the utility and impeding the employment of gas by alarming the public mind, we would beg to annex a few practical suggestions by which its use, even in private houses, may be beneficially extended and enjoyed. . . . A proper regulation of the gas is essential, both for economy and health. . . When gas is employed for the generation of heat and culinary operations, *perfect* combustion should be insured, not only as economical, but also as eliminating the smallest amount of unpleasant products.

There is an exceedingly interesting communication from Lewis Thompson, in the "JOURNAL" for December, 1852, upon this subject—the importance of perfect combustion in the employment of gas-stoves. He says:

The improper use of gas-stoves is a subject upon which Dr. Letheby cannot expatiate too largely, in my opinion; but why are these stoves under certain circumstances dangerous? Is it not from the carbonic acid they evolve? . . . Before quitting this subject of gaseous combustion, I deem it necessary to record some novel facts which have lately developed themselves as the fruit of a long and laborious investigation of several months' continuance. Most persons

* Referring to the practice adopted by the Ipswich Gas Company of *letting* gas-fittings, gas cooking apparatus, gas-baths, &c., to the consumers at a moderate *rental*.

have, no doubt, noticed a peculiar odour present in localities where much gas is burnt, and which is at times much more remarkable than at others, giving rise to the supposition that the gas is occasionally more or less impure. In the examination of the cause of this phenomena, I have been powerfully assisted by my friend Mr. Alexander Wright, of the Western Gas-Works; and to the employment of his apparatus for collecting the condensable products of combustion is mainly due the fact that the real cause or causes of that peculiar odour have been discovered. The smell in question arises from the accidental formation of a portion of aldehyde and formic acid; hence the disagreeable irritating effect produced upon the larynx and glottis of some persons, and which prevents them from remaining long in rooms lighted by gas. The aldehyde and formic acid are not, however, invariably produced in the same quantities, for this depends upon the state of the atmosphere—damp, foggy, or what is called "muggy" weather being that in which most aldehyde is generated. This, indeed, is precisely what theory would indicate, and is dependent upon the circumstance that combustion is at such times less perfect than when the air is dry and adapted for combustion. It is a well-known fact to glass manufacturers and others, who employ large furnaces, that dry, frosty weather is that in which their furnaces burn best; and even a common kitchen fire shows the same thing. In "muggy" weather, therefore, part of the gas passes off not thoroughly oxidized; being partly protected by the carbonic acid and nitrogen of the consumed gas and air, and partly by the presence of moisture in the air, which cools down the outside of the flame below the point of perfect combustion, giving rise to a state of things similar to that induced by spongy platinum with alcohol. Under these circumstances, aldehyde and formic acid pass off into the air of the apartment in conjunction with watery vapour and carbonic acid. . . . The most practical part is the conclusion—that nearly the whole of these obnoxious agents may be got rid of, even in damp weather, by hanging a large ball of spongy platinum, or tissue of platinum wire, at such a height above the flame as to be partially red hot. By this means, the unconsumed matters are mixed with atmospheric oxygen, and burnt under the catalytic influence of the platinum. . . . I believe that a few only of the hydrocarbons in coal gas give rise to the formation of the above compounds, and that their excessive production in damp weather is not wholly unconnected with the method of purification adopted.

The reference which has been made to Dr. Letheby's remarks upon the improper use of gas-stoves, may be extended to the passage in his third report to the Commissioners of the City of London, from which the following is taken:—

I believe that the valuable and economical application of gas to heating purposes is only just beginning to be made available; and it appears to me to be of the greatest importance, both to the manufacturer of gas and the consumer thereof, that the products of its combustion should always be conveyed as speedily as possible into the open air. By directing attention to this precaution, I am quite sure that coal gas may be safely employed to any extent, either as a source of heat or light; and it is not too much to hope that the time is not far distant when its applications will entirely supersede the use of coal.

The "Circular to Gas Companies" for June, 1864, contains a notice of improvements in gas-stoves and fires, and the remarks: "We observe with pleasure the steady progress now making towards the employment of gas as a calorific agent for all the requirements of domestic comfort." This progress would be assisted by the Companies generally, and especially by the managers of the London and other leading gas undertakings. The "JOURNAL" for July, 1851, says: "The application of gas to domestic purposes has of late years largely engaged the attention of managers of gas-works." There was then, too, the issue of the Companies' circular to their consumers and to the public generally. Then there was the Great Exhibition, and also the supplementary action of the Gas-Fitters' Association and their Exhibition at the Polytechnic Institution, London. To this movement, the support of the London and some Provincial Companies was given, as well as pecuniary assistance.

As to the Great Exhibition, no provision having been made for putting the apparatus in action, there could not have been much attractiveness in the exhibits. None of the articles shown has left any impression upon my memory. Nor can anything be found in the "JOURNAL" to refresh it. Looking through the list of awards, there are only about six or seven for gas-heating appliances. Of the Polytechnic Exhibition there is, of course, a notice; and, strange to say, it is accompanied by a reference to the want of what this exhibition had been originally destined to supply, and ultimately did—a view of the apparatus in action. I have no doubt whatever that this exhibition did exercise considerable influence in furthering the objects of the promoters. The Polytechnic Institution itself was at that time a popular place of resort; and all its interesting objects of attraction would be seen by very large numbers of people from all parts, who would carry home with them some new ideas of the application of gas to other purposes than lighting, though this itself was not neglected in the exhibition rooms.

As to the opinions of the gas companies upon this movement of the Gas-Fitters' Association, the Chairman (a gas-fitter, or rather the head of a gas-fitting establishment), Mr. Dethridge, said at one of the early meetings: "From all the letters received, it appeared that the companies did not like to interfere in carrying out the exhibition. They considered, and he fully agreed with them, that it would be much better to leave it entirely in the hands of the gas-fitters themselves." At the following meeting, however, it was unanimously proposed to invite a number of gentlemen to become members of the Committee, and co-operate with it in its exertions to render the exhibition worthy of the patronage with which it had been favoured. A long list of the names of the most prominent men connected with the London Companies followed; and of this list, there is but one who remains—Mr. Livesey.

To return to Lewis Thompson. Those of the gas profession were not the only ones by whom he was honoured. The Society of Arts presented him with three gold medals and a purse of twenty guineas, for his various improvements and discoveries in the arts connected with chemistry.

AUDITING GAS-WORKS ACCOUNTS.

By A SHAREHOLDER.

The subject of the pay, position, and duties of auditors of joint stock companies accounts has been lately presented before the readers of the "JOURNAL" in such a manner as to convey the impression that there is "something rotten in the State of Denmark," and that auditing, as at present conducted, is scarcely worth the paper carrying the official signature. No direct evidence is adduced in support of this sweeping condemnation; but it is based upon assumptions having reference to certain notorious "frauds," all of which, with one exception, are outside our own special industry. In these hard times, when every item of expenditure must be carefully reconsidered, the first question in reply to a proposition for more thorough, but also more expensive, auditing, is a demand for some evidence of a more direct nature than the doings of a dock or a banking company, or the mention of the name of a clerk who, some 40 years ago, aided by a bad system of book-keeping and the unintentional but no less direct assistance of easy happy-go-lucky colleagues, managed to transfer considerable quantities of cash from the coffers of the company to his own private store. The usual reply to questions of this sort, is a dark and mysterious suggestion that these things are usually hushed up; leading to the inference that defalcations of one kind or another are an everyday occurrence, but that, for various reasons, they are very rarely exposed to the light of publicity. Plain business men, however, prefer facts to imagination, and direct evidence to assumption; and following these lines, it is not too much to claim that, judging by results, the present system of auditing gas accounts is at least fairly satisfactory, and that the known cases of defalcations rendered possible by defective or too cursory auditing are not sufficiently numerous to call for a costly, cumbersome, and inconvenient auditing department. Let anyone figure out the cost of such a scheme as that indicated by Mr. F. G. Newton (*ante*, p. 465), together with the hindrance and interference with the regular working, and then show a corresponding benefit. Gas undertakings do not want to increase the establishment expenses; but the elaborate arrangements suggested by that gentleman would require a staff equal to that of the secretary's office, and add an additional standing department to the expenses of the concern. Comparing the expense on the one hand with the advantage gained on the other, it is, indeed, a case of taking a steam-hammer to crack a nut.

Insufficient auditing may perhaps be partly responsible for some of the defalcations alluded to; but it is a mistake to imagine that it is the only one. Smarter auditing might possibly hasten the inevitable exposure that must come sooner or later; but even with the smartest auditing possible, a lively game of pull devil pull baker may go on between the culprit and the auditor to a sufficient extent to cause very serious loss to the concern. The easy-going complacent audit is simply a feature of the way of working the whole thing rather than the primary cause, and is probably attended with careless, unskilful working, and too much reliance upon one individual. Knaves rarely run in pairs; and the chief cause of fraud may be traced to one man management, and to the machinations of one culprit, rendered possible by the unintentional connivances of a sufficient number of fools. Simply giving larger powers to the auditors, with no other change, may aggravate such objectionable features rather than otherwise; for without entering upon invidious comparisons, the honour of a gentleman who can put A.C.A. after his signature is in no sense higher than that of the average director, manager, or secretary, and the shareholders who rely upon one official to vouch for the honesty of the rest will not be better off than those who leave things as they are. The sole object and end of all systems of book-keeping is to secure an accurate record of the affairs of the company, and to enable the same to be efficiently checked and audited; and a professional accountant is usually selected for the office of auditor on the supposition that his special knowledge will enable him to effect that object in a competent and efficient manner. But if the real object and purpose of the auditor is to provide for the honesty of the officials, it would seem that ability of the Sherlock Holmes order was more necessary than a knowledge of accounts.

Then there is not only the assumption that audits as a rule are of a useless character, but that the auditors themselves are well aware of it, and that they give as much as they can for the insufficient pay received, or as much as is possible under the limited facilities at their disposal. But this is scarcely in accordance with facts. Whatever the other directions in which false economy may be pushed, the majority of directors and shareholders believe in efficient auditing; and are willing to pay for the same. If the auditor is insufficiently paid, it is his own fault, as the power at his disposal, according to Act of Parliament, is

almost unlimited. And here it may be wise to trace the relation of the auditor to the shareholders and to the officials of the company. A perusal of the Companies Clauses Consolidation Act, 1845, which is usually incorporated in Gas Acts so far as the powers of shareholders are concerned, shows that it is based on the assumption that every shareholder will take a reasonable general interest in the conduct of the concern. His rights as to entrance to all meetings, secured by the necessity for giving him sufficient notice of the same, his powers of voting, and so on, are evidently intended as something more than a mere safeguard of his interests in case of emergency. The shareholders appoint directors to carry on the affairs of the concern; and the directors in their turn appoint responsible officials to look after the daily operations, and take proper security for the due fulfilment of their duties. Then, sections 106 to 108 clearly set out the duties and position of the auditors. "The directors shall deliver to such auditors . . . . the accounts and balance-sheet . . . . . It shall be the duty of such auditors to examine the same. . . . . It shall be lawful for the auditors to employ such accountants and other persons as they may think proper at the expense of the company; and they shall either make a special report on the said accounts, or simply confirm the same." Sections 115 to 119 distinctly put the responsibility of keeping accurate accounts on the directors.

It is evident that the whole responsibility for the form of the accounts rests with the directors, and that the auditor's function is to examine and either approve or present a special report upon the same. The auditor has no power to alter the accounts. If he does not approve, for example, of the allocation of expenditure as between capital and revenue, he cannot go further than to make a report on the same, and leave the shareholders to approve the adoption of the accounts, or not, as they see fit. And this is quite as much responsibility as can judiciously be trusted to one individual. The shareholders select the directors; and the thing comes down to this—that the shareholders are responsible for accurate accounts, and should not shelve this responsibility upon the auditor or anyone else. If an official appoints a deputy to act for him in his absence, that official is still held to retain responsibility, even for the acts of his deputy; and the shareholders, in appointing directors and auditors, cannot get rid of their responsibilities.

Speaking in a general way, the sense of the Act is not complied with; and the average shareholder sees no farther than the dividend warrant. His sole end and purpose in relation to the concern is to periodically empty the dividend drawer. There has been a great talk in religious and temperance papers about gentlemen of pronounced total abstinence principles who derive large incomes from traffic in stout and whisky, and of strict Sabbatarians who pocket dividends that have been augmented by carrying theatrical companies about the country on Sundays, or by catering for pleasure excursions on that day. But that is not the point at present in view, which is simply the effect of the indifference of the shareholder as regards the business prospects of the concern in which he holds possibly a very important interest. It is safe to say that 95 per cent. or more of the total number are sleeping partners, who do nothing further than to open one eye for a short time at the dividend season. The average experience of the ordinary provincial gas company, having a capital of anything between £10,000 and £100,000 and a shareholder's list of 30 to 300 names, is a case in point. If the chief officials were not also qualified as shareholders, there would have to be a resort to proxies in order to get a sufficient quorum to declare the dividend. Out of a list extending well into three figures, the number who attend regularly on meeting days can be counted on the fingers of one hand; and these attend more as a compliment to some of the directors or officers with whom they are interested, or as a matter of pastime only, or because they like to make a little speech and see it printed in the local newsheets, than from a sense of duty or of responsibility in connection with the conduct of the business.

To some extent it is true that a company has not a soul to be saved or a body to be kicked; but it is also true that it is an aggregate of units who possess both. Yet the shareholder's attendance is simply the baldest matter of form. Of the few who do attend, the majority know little, and care less, about the business, and have not even perused, let alone mastered, the report and statement of accounts. And, by the way, in these days of examinations and statistics, it would be interesting to know, out of (say) 1000 shareholders, what percentage would pass a simple and elementary examination on the ordinary form of account, comprising revenue, capital and balance-sheet. Whether the auditing is a farce or not, it is certain that the annual shareholders' meeting is not much better. The chairman relieves himself of a little set speech, the usual forms of resolutions are carried unanimously, and followed by a vote of thanks. But the careful arrangements as to the powers of a shareholder, his voting, and his right to be present at every meeting, as shown by the fact that every individual must receive ample notice to admit of his attendance, seems to contemplate something more and very different indeed from this. But the practical result is that the concern is run by a small minority of, perhaps, 5 per cent. of the total number of shareholders, most of whom are directors. Unfortunately, the do-nothing policy does not come to a full stop on the shareholders' side of the table, or at the annual meetings, but tends to spread to the directors and their meetings; and it is no uncommon thing to find that the bulk of the labour as well as the responsibility supposed to be taken by a board of seven or nine members, is left to a committee of one or two—the remainder simply taking up the position of "I say ditto to Mr. B."

If a good working body of directors has been selected, it is well that they should have scope for the proper working of the concern, and not be harassed by unnecessary interference. But there is a contingency that was evidently before the framers of the Act; and that is the fact that the good working board will not last for ever. From one cause and another changes continually occur. The committee of two, who have really held the ropes for perhaps a score of years, may pass away, with the result that no one is competent in point of training and experience in the working of the concern to take their place; and the new comers buy their experience at its expense. Many of the little eccentricities of public companies can be traced to the inexperienced zeal of a board, possibly competent, but to a great extent unfledged, smart and business-like in a general way, but weak as regards knowledge and experience in the history of the concern for which they are responsible. This is particularly evident in times of misfortune, of competition, of bad trade, of dear materials, or anything that interferes either partially or completely with the prospects of dividend. The pendulum swings violently to the other extreme; and the absentee shareholders do not hesitate to talk of happy families, cliquism, and so forth—their easy-going complacency being replaced by equally unfounded suspicion, really due to the ignorance consequent upon their own neglect. Instead of being a support and assistance in the time of trial, and coming forward with sound suggestions based upon a prolonged though outside observation of the affairs, they simply aggravate the situation by helpless and aimless fault finding, and possibly by hasty and ill-judged action.

The whole edifice of joint-stock enterprise—as, indeed, of all business affairs—is dependent upon a proper understanding as between man and man, and a mutual confidence. The shareholders feel that their investment is reasonably safe, and that the directors will be true to the trust committed to them. The directors are dependent upon the labours of competent and reliable officials to arrange and carry on the daily operations; the officials depend upon their assistants; and so the thing filters down to the subordinate who actually does the work. Whether we engage a manager to look after the whole concern, or a lad to clean the office windows, the transaction is based upon a confidence that a reliable manager, or a reliable window cleaner as the case may be, can be, and has been, obtained. The directors or the officials appointed to act for them are held responsible for obtaining reliable and competent labour of all classes, from the highest to the lowest, as may be necessary. But it is true, in more ways than one, that nothing is more abused or misrepresented than confidence. There is the weak-kneed specimen exhibited by the victim of the so-called confidence trick, and the iron-handed kind that can be secured with the aid of a *possé* of police. "Confidence" is often trotted out as an excuse for sheer laziness and negligence. The manager, perhaps, has failed to exercise proper supervision over one department, and grave abuses are the result. The excuse for the omission is that he had "confidence" in a subordinate; whereas the fact may be that the real fault is plain and simple negligence, and he has never considered whether the subordinate was entitled to confidence or not. Confidence is even urged as an excuse for something more than mere laziness or negligence.

(To be continued.)

Experiments to test the efficiency of acetylene as an illuminant for lighthouses have (says "Engineer") been carried on in the harbour of Genoa, Italy. The apparatus used consisted of four separate generators; and for a period of 100 days of ten hours each the lighthouse was worked with the new gas with satisfactory results. It is even stated that while the Tino electric light, which is 40 miles distant from Genoa, could never be seen from there, the Genoa acetylene light was quite visible at Tino.

We learn that Mr. E. Boulnois, M.P., the Chairman of the West Middlesex Water Company, has definitely declined to be re-elected Mayor of Marylebone. He regards the example of the City in having a different Lord Mayor each year as one which the Metropolitan Boroughs would do well to follow in fairness and equity. The Council of the adjoining borough of Paddington, however, are almost, if not quite, unanimous in their wish that Sir John Aird, Bart., M.P., will allow himself to be chosen again for the office of Mayor.

After a short existence extending over ten months, the International Carbide of Calcium Syndicate has been dissolved. It was formed last December, and was composed of the owners of German, Swiss, Austrian, Swedish, and Norwegian carbide works; the German Gold und Silberscheide Anstalt of Frankfort-on-the-Main being appointed as the sole sales bureau of the associated undertakings. At that time it was thought that the formation of the Syndicate would be the means of preventing the excessive over-production of carbide, and bring about an improvement in prices. The capacity of the works last December represented an annual production of 50,000 tons; but the consumption was only one-fourth of that quantity, and the disproportion between output and sales was similar in France and Italy. When the Syndicate was formed, it was decided to close most of the works, in order to dispose of stocks; but as the organization has come to an end, it does not appear to have been successful.

TECHNICAL RECORD.

MODERN GAS PRACTICE.

Under the above title, the previous volume of the "JOURNAL"* contained reports of Mr. H. E. Jones's paper on "Modern Practice in the Manufacture and Distribution of Gas," read before the Institution of Civil Engineers in April last, and of the discussion that followed upon it. There has since been considerable further discussion by correspondence, which we are enabled to record as supplementary to the verbal transactions already reported.

Mr. C. E. Brackenbury, who, it may be remembered, opened the discussion, has extended his criticism, which had been curtailed for want of time. Referring to the author's plea for the limitation of capital expenditure in gas undertakings, and for the adoption of inexpensive forms of construction, Mr. Brackenbury remarks that there is such a thing as a humanitarian account to be considered by gas engineers, as well as a capital one; and the former necessitates the introduction of mechanical appliances to relieve the human machine wherever possible, even if such plant proved unremunerative, which is not the case. The author of the paper seemed to prefer manual labour, and thought that, when zealously applied and well directed, it was quicker and more efficient than many of the machines adopted. Yet an inclined retort could be emptied and charged with 7 cwt. of coal in 30 seconds; and stoking machines could easily deal with more than sixty retorts per hour. It was not usually thought advisable to bring cranes with steam-boilers into purifier-houses for filling the boxes with purifying material, as was shown on one of the author's diagrams. Then, among other not generally accepted practices, Mr. Jones used water-sealed valves; and both the tar and ammoniacal liquor went along with the gas to the condenser. The startling statement was also made that coke was "almost universally used for scrubbing or washing the gas with water." Mr. Brackenbury endorses, on the contrary, the use of thin boards in place of coke; and mentions the advantages of washer-scrubbers. He remarks that favourable reports by the authorities, after severe testing, were no proof that Mr. Jones's practices were necessarily the most correct, as it should be shown that the same good, or even better, results could not have been arrived at by more mechanical and scientific means, such as were generally recognized as being those of "modern practice." He heartily welcomed the liberal views of the author on distribution, and particularly thanked him for having emphasized in his conclusion the importance of employing in gas-works properly trained engineers at proper remuneration.

In the correspondence proper, which occupies even more space than the verbal discussion, Mr. C. E. Botley estimated that the yearly increase alone in the consumption of gas, during the past few years, amounted to the total electrical output in the same time. He agreed with the author that this was largely accounted for by the prepayment meter and the incandescent mantle, which latter competed so economically with the powerful electric arc light. He was glad that Parliament had, in some cases, authorized a reduction in the illuminating power of the gas supplied, thereby saving money formerly wasted on enrichment. The advantages of carburetted water gas were generally admitted; but care should be taken that the admixture with coal gas was of a regular proportion, so as to avoid trouble at the consumers' burners. This point, it will be called to mind, was also insisted upon by Mr. C. C. Carpenter in the actual discussion.

Mr. Botley, as well as many others, disagreed with the author that the best material inside scrubbers was coke. He preferred drain pipes, 3 inches in diameter, placed zigzag in rows, one above the other. These could be easily cleaned out by steam; whereas the coke scrubber, when once fouled, had to be entirely renewed. Neither was he in agreement with the author's statements as regards preventing naphthalene deposits by condensation, or by the effect of using carburetted water gas. He truly remarks that climatic conditions unavoidably affect the former; and the latter depends on the nature of the gas itself. Mr. Jones had omitted, in dealing with the subject of gasholder construction, to mention the system of partial guide-framing, which effected considerable economy, and, with proper care in fixing the guide-rollers, &c., was equally secure as the full framing. He (Mr. Botley) corroborated the author's remarks about capital expenditure; but he considered that too much was made of the fact that gas supply was a monopoly, inasmuch as where, for instance, a corporation competed by doing the electric lighting, it had practically a free hand, while the monopolist gas company was fettered in many ways, and by many restrictions. A sympathetic note had been struck by the author's observations on technical training, which should be taken seriously to heart.

To Mr. F. S. Cripps belongs the honour of having contributed the lengthiest criticism—though it is hardly criticism, partaking more of a practical treatise on those subjects upon which he is such a recognized authority, and upon which he always writes so instructively. Gasholder tanks should be of the particular form most suited to local conditions—a truism, no doubt, but a necessary one—of concrete with rendered interior, or with clay puddle backing, of brickwork, or of steel above ground. Cast-iron tanks were out of date, and only to be adopted for small sizes. Steel for a raised tank was the only material to use on water-logged soil; but beyond a certain limit, the bursting strain was so great as to render such tanks impracticable. By arranging double plates for the sides, or by making the side plates curve outwards between the standards, the difficulties of construction were somewhat reduced. It had been his practice, in designing steel tanks partly in the ground, to leave an inch space between the side plates and a dwarf wall built round outside. This space was afterwards filled in with hot pitch, and corrosion thus prevented. Comparisons are then made between the merits and strains of rendered and puddle tanks.

Exception was taken to Mr. Jones's assertion that the former had the advantage of easily showing leaks by the cracking of the cement rendering. Mr. Cripps had not found this to be so. He explained that his theory was that, on emptying a tank to find the point of leakage, the rendering would close up to some extent; while on refilling with water, the pressure would once again open the crack, and so on. The only course, therefore, was to stop the broken skin while the tank was full of water. Obvious as it might seem, it was necessary to state that the *whole* of the inside wall of the tank should be rendered; for he had had a recent case where the brickwork behind the tank-guides had not been done, with the consequence that, when the pressure of the gasholder rollers was exerted, leakage at once ensued. Another practical hint given was never to sink the tank-guides into the bottom. They should stop short by an inch or two, so as to avoid breaking the cement covering. The tank-guides should fit tightly against the rendering, or be properly packed out, if necessary.

A few details were then given of the writer's practice in building concrete tanks, with cement rendering, which he limited to small sizes, evidently preferring puddle backing for large diameters. There follows a brief consideration of some further stresses and strains in tank construction; and other points of difficulty are examined. Approval was given to the author's practice of sloping the gas-pipes in the tank to the angle of the inside cone. Costs were next dealt with. Mr. Jones had given £5 9s. per 1000 cubic feet of gasholder capacity as the cost of a brick-and-puddle tank in favourable clay soil, for a gasholder of 2¾ million cubic feet; whereas Mr. Cripps had designed a similar tank, for a holder at Bournemouth of half that capacity, in the worst possible soil—running sand—at about the same figure. Of course, the smaller the tank, the greater the cost per 1000 cubic feet. When bricks were dear, in 1897, he had built a gasholder tank of concrete and puddle for a million cubic feet holder, burning the excavated clay into ballast, and using it to form the concrete—probably never before done. The cost came out at £3 17s. per 1000 cubic feet. This basis of comparative cost, Mr. Cripps remarked, was hardly fair, as a tank was the same whether a single or a four-lift holder was to be put into it. The comparison should be made on the capacity of one lift only.

The appearance of the author's gasholder framing merited praise, and was light and strong; being constructed on the same lines as the large holders belonging to the South Metropolitan Gas Company. The author deviated in three principal ways from the usual practice in construction: First, in having a number of light standards; second, in doing away with piers to carry them; and third, in setting the foot of each standard in the tank wall itself, without the use of holding-down bolts. These three points are then examined in turn by Mr. Cripps. He remarks that if the number of standards is increased, and made lighter than the smaller number of heavier ones, so also are all the grip carriages and rollers increased, which are rather expensive. Comparing the cost of an ordinary lattice standard holder with one on the author's system, the figures came out respectively at £4 17s. 8d. and £4 18s. 1d. per 1000 cubic feet capacity. For a holder of 1 million cubic feet, the price was £5 5s. 7d. per 1000 cubic feet, or £5 10s. 4d. with trussed crown, as compared with Mr. Jones's £6 13s. for a ¾ million holder on his plain joist plan. Though prices of iron should, of course, be taken into consideration in any comparison, the figures given seemed to show something in favour of the accepted plan of widely separated standards. The abolition of tank piers had much to recommend it, and saved a good deal of money and labour. Mr. Cripps's practice for some time past had been in this direction, having piers in concrete tanks only deep enough to contain the holding-down bolts. Where the piers were tapered off from the tank wall, hooking-irons were added to give greater strength. Undoubtedly, the two back bolts of standards might be made very short in a shallow pier; while the two front ones might be kept as long as usual, to grip the tank wall firmly.

With regard to the third point of divergence, it would seem that a very little movement in the standard, which would act as a lever, might cause damage to the tank and lead to leakage. The strain from a holding-down bolt was exerted lower in the tank, where the wall was stronger, and better able to resist it. The weight of the 18 inches or so of the standard let into the wall would be about the same as that of the usual bolts; but there was a saving in erection, as bolts were rather awkward to fix satisfactorily. Mr. Cripps then gives some very interesting details about an old gasholder that he had been called upon to add a new lift to. The tank guides were not in line with the standard ones; the carriage cheeks had high necks, if the phraseology may be allowed; the inside vertical bars were many times too strong and heavy; the cup was only 14 inches in depth, whereas

* See Vol. LXXVII., pp. 1055 and 1116.

no cup should be less than 18 inches; strips of strong plates radiated from the crown centre, with intermediate rows of thin sheets; the rise of crown was double what it should have been; and so on goes the category of false points in original design, from the study of which much may be learnt. Mr. Cripps brings his remarks on gasholder construction to an end with a plea for trussed crowns. He believes that holders up to 175 feet diameter should have them, as the extra inside weight would prove useful in giving increased pressure, which was often needed, when only the top lift of a holder was left in action—in some cases a fan having to be used to get the gas away. Attention is then drawn to purifier construction. Mr. Cripps considered it better to have the discharge pipes in segments corresponding to the lines of sieves, instead of in one piece as arranged by the author. Dry-sealed boxes were becoming very general. Mr. Jones's plan of holding down purifier covers partly in the central area was a great improvement on the usual method of doing this altogether from the sides. The cover plates could be made lighter, and the strains were generally reduced. Practical experience had shown that the up-pressure exerted on a large purifier cover might prove enough to lift the box clean off its foundations.* As there were no water lutes to blow, pressure might quickly increase; and it was, therefore, doubly important to prevent the sides from lifting, and to give every attention to the question of strains. Curved covers should be adopted, where practicable, in preference to flat ones, which, under any great pressure—say, 36 inches head of water—were a source of weakness. This concludes Mr. Cripps's remarks, which, though unusually long, are, as will be noted, interspersed with many practical hints that will without doubt prove of interest and value to many, not only now, but in times of future reference.

The next contributor to the written discussion was Mr. Percy Griffith, who confined his observations altogether to the financial side of gas undertakings. The author had strongly advocated the limitation of capital expenditure, and considered that more economy would accrue from that source than from mechanical appliances. For a 50 million cubic feet gas-works, he had put the figure for works, mains, and working capital, at £400 to £500 per million cubic feet. This, Mr. Griffith thought, was not justified by experience; and, unless qualified, it was a misleading statement. It was true that the author's works, in 1899, came out at £416 per million cubic feet, the South Metropolitan Gas Company's at £425, and the Wandsworth works at £366; but the London average was £550, and of twelve Suburban Companies, £558. Something exceptional, therefore, no doubt accounted for the author's low figures, which were, moreover, altogether inapplicable to small gas-works. The sum required per million cubic feet sold per annum for the less important undertakings was, on an average, over £1000; while a case within Mr. Griffith's knowledge had a capital of over £2500 per million, upon which, however, a dividend of 4 per cent. had been paid, owing to the rapid development of the business. Another instance was cited of a £2000 per million gas-works, which had yearly increases in gas sales of 15 and 20 per cent.; so that the capital in proportion to the output would rapidly diminish. From such illustrations, it would be seen that the low capital ratio given by Mr. Jones must not be generally accepted, particularly as regards small works. Further, it should not be overlooked that growing works had land, sidings, and buildings provided in excess of actual requirements, which caused temporarily inflated capital. In short, the author's comparisons on a capital ratio basis were not worth very much, unless the efficiency and other items of a works were taken into consideration as well. Any capital outlay which was in itself remunerative was obviously justifiable.

Mr. N. H. Humphrys' remarks also partook somewhat of an inquiry into questions of financial bearing. He added a fourth reason to the author's three to explain the gas developments of recent years, as he considered that the more business-like and pushing attitude adopted by gas companies towards their customers had contributed to such increase, over and above that accruing from the Welsbach burner, the coin meter, and the sliding-scale legislation. Formerly, an average gas company considered its duty done by delivering the gas at the consumer's meter, and so concentrated its attention upon small economies in manufacture. The question of the price of gas had been looked upon as all-important; and this had been fostered by the sliding-scale legislation. Yet it might be doubted whether this attention to price had not been overdone; for a consumer who paid 2s. per 1000 cubic feet and used his gas badly, under the advice of his local plumber, was worse off than another, paying perhaps 3s., who burnt the gas properly, as advised by the gas officials. The sliding-scale had also been responsible, owing to its accompanying auction clauses, for dividends that were nominal only, and thus misled the man in the street as to the real benefits derived by the gas investor. A word of praise—and, we think, justly—was given to the manufacturers and sellers of gas cooking-stoves for having driven home the lesson that cheap gas and high dividends were not the only objects of a gas company's existence. They had promoted gas appliance exhibitions and cookery demonstrations, and thus brought into intimate contact the gas manufacturer with the gas consumer. The progress made with the incandescent burner and mantle had not at all been such as they had, on their merits, deserved; and Mr. Humphrys follows this up with some severe comments on the causes of this backwardness. The coin meter and the management of coke sales then come in for some consideration; while as to tar, the price of which decreased rather than the reverse, notwithstanding the valuable extractions got from it, more was paid for it by a man who wanted to cover a fence with it than by a chemical manufacturer. Low capital, Mr. Humphrys remarks, the subject of residuals being concluded, was like cheap gas; it was a hobby that could be ridden too hard. He was not an advocate of extravagance, and bloated capital meant dear gas; but there were also instances of the latter with small capital. What was gained on low interest charges was more than lost by high working expenses connected with old-fashioned, cheap, and inefficient plant, and by being driven beyond its normal capacity. Both extremes should be avoided, as money was wasted when either extravagance or parsimony was indulged in. Gas would eventually have to be distributed under much higher pressure than is at present the custom—no longer measured by tenths of an inch but by head of water in feet. In America, natural gas was sent out under a pressure of 50 lbs. per square inch, and was effectively reduced at the consumer's premises. So in England, with 20-ton steam-rollers on our roads, our gas-mains should be made to withstand higher pressures. There was not in all this contribution by Mr. Humphrys very much in the way of direct criticism or discussion on Mr. Jones's paper. Yet it contains, as has already been remarked, many true observations, and calls attention to some common-sense points that are sometimes in danger of being overlooked.

Many present at the Institution of Civil Engineers to hear the actual discussion must have remarked the absence of some of the leaders of the gas industry, whom they would gladly have listened to, knowing full well the ripe judgment they bring to debate. Such an one, whose unavoidable absence was regretted as much by himself as by those present, was Mr. Charles Hunt, who himself had contributed to the proceedings of the Great George Street Institution the previous gas paper,* as one of the speakers called to mind. Mr. Hunt has, however, taken full advantage of the opportunity of joining in the written discussion, and has passed some very trenchant criticism on certain of the author's statements. The first point taken was with reference to the coin-meter system of gas supply, which Mr. Jones had described as conforming to "modern municipal aims." It is pointed out by Mr. Hunt that the largest municipal gas undertakings were but small users of such meters, not owing to being behind the times, but on account of being before them, as, under municipal control, gas had been largely used by all classes of consumers long before their introduction. In Birmingham, the average consumption per prepayment meter was about half that in London, from which it might be assumed that a lower or poorer class of consumer was reached in the former city than in the latter. Gas companies had much more leeway to make up in extending their business than municipally controlled works. He did not agree with the author's claim for the sliding-scale—that it had led to improvements in manufacture. It was right enough that shareholders should benefit proportionately to good management; but the latter could not be evolved out of indifferent management by any sliding-scale legislation.

Again, the author seemed to him to think that labour-saving appliances were also indirectly due to the same legislation. Yet surely Hone's invention, for example, for unloading coal-boats, would have been adopted by the London Gas Companies altogether apart from the sliding-scale. Further, stoking machinery that was so extensively adopted to-day was the invention of a non-sliding scale gas company's engineer, afterwards appointed chief to one of the largest municipal gas-works. Manchester had used such machinery since the seventies; and the Birmingham Corporation, on acquiring the gas undertaking, had at once introduced and worked it since the year 1883. What had Mr. Jones done in this matter, and when had his Company introduced retort-stoking machinery, though they put themselves under the sliding-scale in 1875? Had he adopted machines before 1896 or 1897, quite twenty years later? And even when they were adopted, the machines were chiefly the invention of a municipal engineer—to wit, Mr. William Foulis. Glasgow, Manchester, and Birmingham had been among the first to adopt labour-saving appliances, not one of which was in any way affected by the sliding-scale legislation, which, according to the author, had been the indirect cause of the adoption of such plant. Arrangements made and mentioned by the author to avoid fixed elevators, &c., were all very well; but he should not have omitted to explain that they were only possible with fine coal that required no breaking, as in London.

Another instance of what Mr. Hunt very pithily and pointedly describes as "local colour," occurs in the author's reference to the supposed "creeping" of coal in inclined retorts, which objection, Mr. Jones remarks, "must be absolutely overcome before the system can make much headway." Mr. Hunt naturally and truly replies that it is making "remarkable headway;" and he proceeds to quote chapter and verse. All over Germany, for instance, Birmingham, Coventry, Manchester, Salford, Leeds, Edinburgh, Nottingham, Huddersfield, Burnley, and a host of other places, all had put up inclined retorts. He goes on to remark that the significant fact is that the latest installations were also the largest; quoting, again, Birmingham and Edinburgh. "How, then, was it possible to accept the author's dictum, except, perhaps, as applicable to a somewhat limited metropolitan area?"

* See "Strains in Large Purifiers." By F. S. Cripps.

* See "JOURNAL," Vol. LXIII., p. 651.

Turning to the question of carburetted water gas, Mr. Hunt did not see why carbonic acid should be referred to in the paper as an impurity, as it was only a matter of using additional oil, if not more than 3d. per gallon, or of removing it by lime, whichever proved the cheaper at a particular time. He did not agree that water gas facilitated the removal of naphthalene deposits; and in this, it will be seen, Mr. Hunt corroborated Mr. Botley's observations. This was also the case as regards condensation. Tar with the gas might be capable of taking out all naphthalene; but temperature was the greatest factor. Mr. Hunt had shown, by his paper previously referred to, that the higher the temperature at the condenser outlet, the greater the number of deposits. The real cure was to be found in the retort-house, as they were the result of bad, and not good carbonizing.

Other points dealt with by Mr. Hunt referred to continuous recuperative furnaces, which were not due to any Siemens; to concrete and brick tanks, the former costing at Birmingham 17s. and the latter 21s. per cubic yard (compared with Mr. Jones's 10s. and 25s.), cement rendering also being generally cheaper and better than puddle; and to the absence of mention of the different forms of columnless gasholders, which last had been commented upon by so many speakers and contributors. For quite a quarter-of-a-century, hardly any mains less than 4 inches in diameter had been laid in Birmingham; and he was therefore somewhat surprised at the author deprecating 2-inch pipes, as he (Mr. Hunt) had supposed they were now obsolete in large undertakings. Wet meters continued to be exclusively used in Birmingham; so Mr. Jones's remarks concerning their practical displacement did not apply to that city.

The next contributor, in alphabetical order, is Mr. Walter Hunter, the Deputy-Chairman of the Commercial Gas Company. He fully endorsed the author's views on economy in capital expenditure; and gave figures presumably in support of the contention that profits on capital mounted up accordingly as that capital was reduced or kept at a low amount. The electric light had increased the demand for better illumination, and so had augmented the gas consumption. He thought the Rue de la Paix, in Paris, was the finest high-pressure street lighting installation he had seen. His further remarks were taken up with the competition between gas companies and electric lighting bodies, with an appreciation of the coin meter, and with the advantages of carburetted water gas as an adjunct to coal gas; and he concluded with the observation that labour-saving machines were of no use unless they cheapened the article produced, or obviated operations injurious to health.

The last contributor to the written debate was Mr. William R. Hutton, whose remarks were in no way related to the paper under discussion, but whose description of the state of gas affairs in New York was sufficiently interesting, and would have been more acceptable through other channels. The annual consumption of gas at present in New York was 25,000 million cubic feet, and in Brooklyn 4400 millions, which together supplied a population of about 3½ millions. One-quarter was coal gas, the rest being carburetted water gas, which would eventually be the only gas supplied. Some details are then given relating to the construction of steel gasholder tanks, some being of double plates, ⅜-inch thick, as referred to by Mr. Cripps. Much confusion existed owing to the number of gas-mains in the streets. Electrolysis had caused a considerable amount of damage, but had been reduced by adopting better return-conductors.

This concluded the discussion by correspondence, to which the author replies. He observes that only coke-filled scrubbers will meet the conditions of purity demanded in London; and with reference to naphthalene deposits, his remarks had been based on twenty years' experience at the Epsom Gas-Works, which experience could not be upset by any opinion. He agreed with Mr. Cripps's instructive and interesting observations on the differences between cement rendered and puddle tanks, and also as regarded the great difficulty of building metal tanks of large diameter. Of course, space did not allow him (the author) to deal with tank and gasholder construction at the same length as Mr. Cripps had done. Segmental discharge pipes in purifier-boxes would prove a source of leakage; and contamination of the gas might follow. Provincial gas engineers had no idea of the severity of the London County Council tests, and the consequent delicacy of the conditions to be maintained. He could not accept Mr. Griffith's suggestion that he had put the capital required by small works at too low a figure. Small works were necessarily simple to construct, and free from expensive machinery. Rates per million cubic feet naturally increased with smaller works; but a works of 2 or 3 million cubic feet per annum would cost £1200 per million. He was in agreement with Mr. Humphrys' observations on the incandescent burner and coin meter, and on assisting the gas consumer with advice, as the author himself had also advocated. He spoke more from the "company" side of gas supply, and had found the sliding-scale most valuable; whereas Mr. Hunt approached the question from a municipal standpoint. With regard to the adoption of stoking machinery in the author's works, Mr. Hunt overlooked the fact that the Commercial Gas Company had up till recently been working on too small a scale to introduce it profitably. His remarks on inclined retorts were, Mr. Jones thought, adequately met by those of Mr. Carpenter. Surprise was expressed that water gas had not assisted in clearing naphthalene deposits at Birmingham; and it might be explained by supposing that the water gas there was of low lighting power, compared with that required in London. He had omitted columnless holders from the paper, because it "was intended to deal with what he could rely upon and approve." Mr. Hunter's criticism was "too favourable" but "valuable;" and Mr. Jones appreciated Mr. Hutton's remarks as to gas practice on the other side of the Atlantic. On the main points of his paper, the author was glad to have the concurrence of so many engineers of important undertakings.

Thus concludes a lengthy discussion on a paper of wide scope, which has raised considerable controversy and met with strong criticism, which has brought out many points of divergent practice, but which has proved also full of interest and instruction.

TESTING OF GAS BY MUNICIPALITIES.

M. Michael Angelo Scavia advocated in a recent number of the "Rivista Tecnica," of Turin, a system of testing the quality of gas, based upon chemical analysis. Such a suggestion, says "Le Mois Scientifique et Industriel" (No. 1, 1901-02), seems to us to be difficult to introduce into practice, owing to its inefficacy. As it would be almost impossible to codify, it would involve complications, and, in particular, give rise to litigation from which the most conscientious experts would find it hard to extricate themselves. The variety of the analyses quoted by M. Scavia from documents collected in certain large towns, proves that we should have to accept such wide limits in the centesimal proportion of the constituents of gas "admissible," that effective regulations would be impossible. Moreover, the practical qualities of a lighting gas—and at the present time, if we take incandescence into consideration, the question is chiefly one of heat—are due to the total number of the constituents, and not to the greater or less proportion of one of them. The very interesting work of M. Scavia comes too late. In future, the light-giving property of illuminating gas depends upon its heating much more than upon its lighting power, strictly speaking, as defined by MM. Dumas and Regnault in 1860.

The selling value of gas results from the thermic efficiency of the burners employed—*i.e.*, from the calorific power of the gas—but it also results from the method of combustion, the proportion and perfect mixture of the primary air in the bunsen burner, the temperature obtained, &c. However, the calorific power of gas is far from indicating all the circumstances accompanying combustion in incandescent burners, as regards the thermic effect of the gas burnt. Moreover, in speaking of the calorific power of gas, we suppose products of combustion brought to 0°C. But as aqueous vapour is not condensed in combustion by the Auer burner, there is a loss of 12 to 15 per cent. in the utilizable heat units. This loss varies with the proportion of hydrogen contained in the gas; it is less when the heat of combustion is due mainly to carburized elements. The more or less perfect mixture of primary air plays an important part both in cooking and incandescent lighting; and on this point the calorific power of gas, as tested at the laboratory, is silent. A little oxygen in the gas would increase the flame temperature; for all access of secondary air around the mantle causes loss of heat. Temperature may be called the poetry of combustion; but analysis of gas furnishes no data regarding the temperature of the combustible in question.

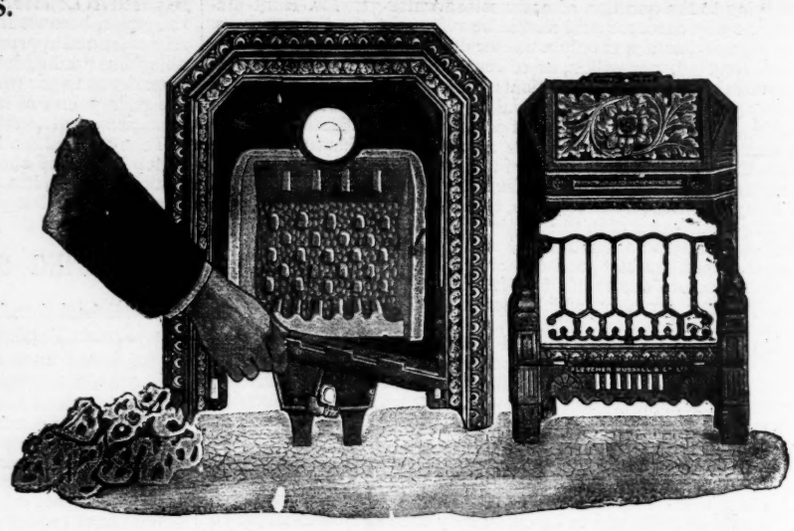
The examples given by M. Scavia demonstrate, better than any argument, the futility of the chemical test, by the variations they furnish for each constituent of the gas in different towns. It is interesting to compare European gas with that of New York, as is done in the following table, showing the chemical composition of the coal gas supplied in various towns:—

—	CO_2.	Hyd.p*	O.	CO.	N.	H.	CH_4.	Cl.†
Turin Gas Company.	1·50	3·25	0·52	6·31	1·80	55·83	31·06	..
Do. (Soc. Constructeurs)	1·14	3·00	0·90	4·37	5·12	55·68	29·90	..
Berlin	3·00	4·20	0·40	10·10	2·60	50·30	29·40	5200
Zurich	..	..	..	..	..	..	..	5200
Munich	2·30	4·50	..	8·60	2·80	49·40	32·40	5400
Budapesth	2·33	4·88	0·20	5·88	0·71	51·32	34·68	..
Berne	2·50	4·50	traces	6 to 7	3·00	47·00	35 to 37	5600
Paris‡	1·79	4·94	..	8·21	2·00	50·10	33·03	5300
London	0·60	3·47	0·49	6·23	3·23	52·22	33·76	..
,, 1900	0·79	4·38	0·15	2·62	0·96	47·08	32·99	..
Minimum	0·60	3·00	..	2·63	0·71	47·00	22·90	..
Maximum	3·00	4·88	0·90	10·10	5·12	51·08	37·00	..
New York	2·50	16·50	0·50	27·00	2·00	35·00	17·05	6595§

* Hyd.p. = heavy hydrocarbons. † Cl. = average calories per cubic metre.
‡ Paris gas, with 4·94 per cent. of hydrocarbon by weight, contains 1·06 per cent. of benzene. § 740 B.T.U. per cubic foot.

In short, the methods of testing now employed on the Continent, especially in Paris, for ascertaining the purity of gas, as far as regards ammonia and sulphur, are efficacious and sufficient. As to the illuminating power of the gas, the photometric methods adopted in Paris, based on the Dumas and Regnault system (1860), also constitute the best test for use by municipalities. But the question arises as to whether or not we should endeavour to substitute the incandescent burner for the Bengel hitherto adopted as the standard of comparison. For some pronouncement on this and other matters connected with this question, we must await the conclusions of the Photometric Commission appointed subsequently to the Paris Congress of last year.

REMOVABLE GAS-FIRE BURNERS.



It is not an unusual thing to hear a complaint from users of gas-fires that they are unable, after a season or two's use, to obtain from them the same amount of heat and incandescent brilliance that they enjoyed when the stove was new. The consumer's limited knowledge of gas and its combustion, of bunsen burners, and such-like matters, does not always assist him in coming to an intelligent conclusion as to the cause of this lapsing from the high standard of virtue which his stove formerly possessed; and so the quality of the gas, as a rule, falls under condemnation. Then the time arrives when it occurs to the consumer, or someone suggests, that a complaint should be made to the gas suppliers; and so the truth comes out. The stove is removed (either by the gas suppliers' men or the consumer's gas-fitter), cleaned, and all is well again. But after one experience, consumers are often loth to have the operation repeated. They do not like their rooms to be disarranged, nor do they admire the appearance of the fireplace when, if necessary, the stove is removed; and the dust and dirt which the removal and replacing cause distress the housewife.

Messrs. Fletcher, Russell, and Co., Limited, have brought out an improvement which will do away with all this, and will, there is little doubt, help to raise the gas-fire to a higher level of popularity than it has yet succeeded in reaching. The illustration shows the improvement as applied to the "Canton" fire. But, in passing, it may be mentioned that at the present time the "Hong Kong" and "H" types are made in the same way; and it is more than possible that the improvement will later on be applied pretty generally to the firm's gas-fires. Now with this improvement, all that has to be done when the stove requires cleaning is to remove first the front as shown in the illustration. This is easily accomplished, as the front is merely kept in position by resting in two slots at the bottom and by a single screw at the top; so that by taking out the screw, the front lifts off. Then the gas-pipe serving the burner has to be unscrewed, and the burner lifted out for cleaning. If it is necessary for the fitter to take the burner away, the front of the stove and the fire-clay balls can be replaced; and thus there is no disfigurement of the room. The whole job only takes a few minutes; expense is lessened; no annoyance is occasioned by dust and other causes; and moreover the gas-fitter has no excuse for keeping the fire out of action for any lengthened period. The whole thing is as simple as it can be; and it seems to us that, by exercising care in screwing the supply-pipe well home, the consumer could (if no repair to the burner was needed) do the cleaning himself periodically, and so ensure a fire constantly up to the mark. There is not a great deal in the way of invention about this; but it is just one of those useful and convenient improvements which are so valuable in the assistance they give in affording to the gas consumer relief from trouble and extra expense, and that is what he appreciates to the fullest extent.

While writing on this matter, it may be mentioned that, in the show-rooms of Messrs. Fletcher, Russell, and Co., we saw some new and handsome designs in mantles and tiled fireplaces for use with gas and other fires.

A NEW PIPE JOINT AND CONNECTION.

A serviceable pipe joint and connection (which will be known as the "Hurst" patent) has been brought to our notice by Messrs. Fletcher, Russell, and Co., Limited; and its general applicability, its strength, durability, and perfect tightness have been established to our satisfaction. The illustrations which we give are

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

almost self-explanatory. Fig. 1 is a 1-inch main ferrule, fig. 2 a ½-inch lead-to-lead connection, fig. 3 a ½-inch section, and fig. 4 a ½-inch meter connection. Fig. 3 clearly indicates the character of the joint and the method of using it; and with that section before him and the printed "instructions to plumbers," the reader will not require further description. The instructions are: "Unscrew union-nut and protrude ends of pipe about ½ inch, turn over the ends on to flanged ferrules, and drive turnpin tight into the end of pipe. After turning flanges, cut off the pipe level with the sides of metal flange, and screw up tight with coupling-nut. This causes the lead flanges to press into the threads of the coupling-nut, and completes the joint. A ring or washer of lead wire or other washers can be used where required for high pressure." This joint, which is strongly made, is suitable for every class of lead, block tin, light copper, and soft metal pipes; also for connections to gun metal, brass and iron fittings, and pipes for hot and cold water, and rubber and flexible tubings for gas fires and cookers. Both the connections and joints are made in a variety of sizes; and their advantages are many and obvious. From their very simplicity issue most of their good qualities. An engineer does not need to be told that a joint which can be made so readily as this one occupies considerably less time than the making of an ordinary wiped joint. Thus a man's time is saved; and that time means money. Of the strength and security of such a joint, little need be said. It is sufficient to say that it has been put under a pressure of 1000 lbs. at Manchester, and has stood it well. A joint which will stand that, will not fail under ordinary pressures. The facility with which pipes can be disconnected and reconnected an indefinite number of times without injury to pipe or connection, is also a valuable consideration; and its usefulness in positions which would be awkward for making an ordinary joint is a point not to be lost sight of. No light or heat being required, the question of safety also arises in the making of joints in proximity to a gas-meter; and the impossibility of making a joint by soldering when a pipe is wet is overcome. It is unnecessary to multiply the advantages of this handy device here, as they will be apparent to all gas and water engineers. It will be found among the exhibits at the Sanitary Exhibition at St. Andrew's Hall, Newman Street, Oxford Street, from Wednesday to Friday this week, and at the Brewers' Exhibition at the Agricultural Hall from the 19th to the 26th inst.

Kitson Lights for Lighthouses.—The Kitson burner has been installed in the Lowestoft High Lighthouse; and on Wednesday night it was formally inspected by a Committee of Elder Brethren of the Trinity House, who were accompanied by the Chief Engineer (Mr. T. Matthews, M.Inst.C.E.) and Admiral Stewart. Mr. Arthur Kitson and Sir Ralph Knox, K.C.B., were also present. The Committee drove to Gorleston Pier to witness the effect of the light; and the trials were pronounced eminently satisfactory. The candle power of the light through the lenses is fully three times that of the former wick-lamp; and it consumes only one-fourth as much oil. Moreover, the light is very white and penetrating. As a result of the tests, the Committee decided to adopt the light permanently.

Preliminary Investigations for Water Supply.—This was the title of a paper submitted by Mr. Sydney A. Hollis, at the meeting of the Society of Engineers on Monday last week. The author first pointed out the difficulties which were encountered by engineers in tropical and sub-tropical countries in gaugings both of rainfall and rivers. Some statistics of remarkable and erratic rainfalls in the Cape Peninsula were given. The author then gave a detailed account of the gaugings carried out by him at Steenbrass River, Cape Colony. He stated that the gaugings were taken with a view to the ultimate formation of a large storage reservoir by means of a dam across the mouth of the valley; the object being to obtain a supply of water for some of the suburbs of Cape Town. A large gauge weir was erected, measuring 60 feet across; and it was found that the flow of water in the river fluctuated between 500,000 gallons and 300 million gallons in the 24 hours. A description was given of the river gauges constructed to measure the flow of water in winter and summer, with particulars of the number and position of the rain and evaporation gauges.

INCANDESCENT STREET-LIGHTING IN SAN FRANCISCO.

Among the abstracts of papers given in the last published volume of the "Minutes of Proceedings of the Institution of Civil Engineers" is one referring to the above subject. The Welsbach lights are of 100-candle power, in clusters of one, two, or three burners, placed 160 feet apart along the line of the street, or 180 feet measured diagonally across it. Compared with the electric lighting, a much better distribution of light is obtained, as the area of the mantle "per candle power" is much greater than that of the glow-lamp filament or arc-crator "per candle power." Also, as has been proved elsewhere, the composition of the Welsbach light makes it much more penetrating in foggy weather than the electric arc light. It is stated that lighting by incandescent gas is rapidly and permanently displacing all other methods of street illumination. The cost of public lighting in San Francisco is given as follows:—

Ordinary gas lights . . .	22·0	candle-hours for 1 cent.
Arc lights	85·7	,, ,,
Welsbach lights	111·0	,, ,,

On a basis of the number of inhabitants per 100-candle power of street illumination, San Francisco comes out the best of all, having 40 inhabitants per 100-candle power, while New York and Brooklyn have 86.

DEVELOPMENT OF HIGH-POWER GAS-ENGINES.

In the course of a discussion on engines for dynamo driving, at the opening sessional meeting of the Manchester Association of Engineers, held last Saturday, Mr. A. V. Coster remarked that he had been a steam engineer for some years, but had lately been more interested in gas-engines, and he wished to remind the members that there were large firms in the district who were turning out these engines just as capable of driving a dynamo as a steam-engine was. Engines of over 500-horse power were running in the country to-day; and not only in England but on the Continent, engines of very large power were being made. There was in the neighbourhood of Manchester a gas-engine of 500-horse power, which could be started in 2½ minutes. Was there any steam-engine of which this could be said? It had run day and night without stoppage for upwards of 50 days. Another engine in the neighbourhood, used for generating electricity, had also run continuously for more than 136 days. They were only just commencing operations in the larger sizes; but he thought that in a few years steam-engine builders would find the makers of gas-engines coming into very strong competition with them. Great advances had been made in the production of gas, with the result that they did not now depend merely upon coal gas for motive power. Not only was there the Mond gas, but Messrs. Crossley made gas, and could well compete with anything the Mond people could do. Was there no fear in the ranks of steam-engine makers as regards the progress of gas-engine makers? Messrs. Willans and Robinson, whose steam-engines were well known to all, were, he believed, at the present time experimenting with a gas-motor. Good gas could be made from slack coal at 7s. per ton, and be supplied to gas-engines for power production at a cost of less than ½d. per brake horse power.

PRODUCER GAS AND ITS APPLICATIONS.

In the "Iron and Coal Trades Review," early in the year, a series of articles appeared on the above subject by Mr. F. J. Rowan, Assoc.M.Inst.C.E., of Glasgow. The first two were of a more or less historical character; but in the third the author dealt with the composition and merits of gaseous fuel, on which subject he offered the following observations.

In the case of producers which supply gas for use in furnaces to which it is conducted direct, without any separation of the various qualities of gas yielded at different stages in the producer, or without any preliminary treatment of the total gas for the recovery of ammonia, or for the removal of dust, tar, or soot, it is usual to have the air blast supplied by the induced current due to a jet of steam admitted into the narrow neck or throat of a tapered trumpet-shaped pipe. The delivery of the air and steam inside the producer has been arranged in different ways in various producers; and the position of this inlet exerts some influence on the composition of the resulting gas. The best position is undoubtedly the centre of the mass of fuel, and as near the bottom of the producer as is consistent with provision for cleaning out the ashes; because this ensures the passage of the air through the fuel, so that its oxygen may be combined with the carbon, and that none may reach the surface in a free state and be thus able to cause the gas to burn there. If air is admitted by tuyeres or boxes at the sides of the producer, it is easy for some portions to creep up between the fuel and the producer lining, and ignite the gases at the surface of the fuel.

Some producers have been worked with an air blast alone; but this causes a higher temperature in the zone of combustion, an almost entire absence of hydrogen and hydrocarbons from the gas, and a greater formation of clinker in the producer. The effect of introducing steam is to lower the temperature of combustion, and so protect the producer from destructive action; while by the decomposition of the steam (in addition to its regulating the temperature), hydrogen is added to the gases, and the lower temperature preserves some of the volatile hydrocarbons from being decomposed. The percentage of carbonic acid (carbon dioxide) is, however, increased, and that of carbonic oxide (carbon monoxide) frequently decreased. If the quantity of steam admitted is in excess, the resulting gas contains more carbon dioxide and hydrogen, though less nitrogen in proportion. If ammonia is to be recovered from the gases, the combustion of the coke or fixed carbon of the coal in the producer must be conducted at a low temperature in the presence of a large excess of steam, or of hydrogen in such a form as to provide both for the combination with the nitrogen existing in the coke, and for the preservation of the ammonia when formed.

To quote some representative examples of the quality of gas made in different producers, the following two analyses show the composition of the gas from Ebelmen's producer, using wood charcoal as fuel, (1) with dry air blast, and (2) with air and steam:—

	Carbon Monoxide. CO.	Hydrogen. H.	Hydrocarbons. CH_4, &c.	Oxygen. O.	Carbon Dioxide. CO_2.	Nitrogen. N.
(1)	33·3	2·8	—	—	0·5	63 4
(2)	27·2	14·0	—	—	5·5	53·3

The next two are from Siemens sloping-grate producers, using (3) coal, worked by ordinary draught, and (4) with closed ash-pit and steam-jet air blast:—

	CO.	H.	CH_4, &c.	O.	CO_2.	N.
(3)	25·6	—	4·4	—	4·3	65·7
(4)	24·4	8·6	2·4	—	5·2	59·4

The two following are average samples of gas from Wilson producers, with (5) steam-jet blast, using Durham coal, and (6) using fine Yorkshire slack:—

	CO.	H.	CH_4, &c.	O.	CO_2.	N.
(5)	26 89	11·55	1·45	—	4·00	56·11
(6)	23·41	13·82	2·22	—	4·69	55·86

The two following are from a Phillips producer, (7) working with fan blast, and (8) working with steam blast:—

	CO.	H.	CH_4, &c.	O.	CO_2.	N.
(7)	27·31	—	1·4	—	3·9	67·4
(8)	20·00	8·7	1 2	—	8·7	61·4

The next is an analysis of gas made in a Dowson producer, using superheated steam and induced air blast, and working with Garrant anthracite:—

	CO.	H.	CH_4, &c.	O.	CO_2.	N.
(9)	25·07	18 73	0·62	0·03	6·57	48·98

This analysis was made by the late Mr. W. Foster, and bears evidence of his usual care and thoroughness. Finally, we have two analyses of gas from the Young and Beilby apparatus, in which coal was being treated in a gas producer with excess of steam, in order to secure the nitrogen of the coke as ammonia in the gases; (10) being an analysis of the gas as actually made, and (11) a corrected analysis showing what a lessened proportion of air to steam would produce:—

	CO.	H.	CH_4, &c.	O.	CO_2.	N.
(10)	8·10	28·60	2·3	—	16 60	44·40
(11)	10·72	37·19	—	—	21·32	30 77

The resemblance between (No. 10) and a specimen of gas from Mond producers is shown by the following analysis of Mond producer gas, as given by Mr. H. A. Humphrey in his papers on the subject:—

	CO.	H.	CH_4, &c.	O.	CO_2.	N.
(12)	10·00	26·0	2·5	—	16·0	43·8

This sample of gas was taken from Dr. Mond's producers when being worked with a large excess of steam for the recovery of ammonia from the gas. It corresponds with an analysis of gas from the Duff gas-producer plant when worked under similar conditions with good slack, as the following shows:—

	CO.	H.	CH_4, &c.	O.	CO_2.	N.
(13)	11·0	28·0	2·5	—	15·5	43·0

It will be understood that by sacrificing the yield of ammonia the quality of the gas can always be improved for heating purposes. In the case, for instance, where Duff producers are worked to supply gas for heating furnaces direct, a much better quality of gas from a calorific point of view is made, taking into account the smaller quantity of undecomposed steam in the gases and the smaller proportion of carbon dioxide. The following is an average of daily analyses, ranging over a period of several weeks; the gas having been made in a Duff producer worked for heating gas:—

	CO.	H.	CH_4, &c.	O.	CO_2.	N.
(14)	26·8	13·4	4·4	—	4·0	57·4

In all these analyses, the figures in the first three columns added together give the percentage of combustible material in the producer gas, and those of the last two columns the non-combustible elements. Thus, excluding analysis No. 9, which is from a producer worked with anthracite in order to supply gas for a gas-engine, the ordinary quality of gas made from coal in producers worked with blast shows from 30 to 41 per cent. of combustible, and from 59 to 70 per cent. of incombustible ingredients. Those worked with steam blast have the advantage, as Nos. 2, 4, 5, 6, 8, and 14 demonstrate. The Dowson producer

analysis No. 9 shows 44·4 per cent. combustible and 55·5 per cent. incombustible; and that of Mr. Duff (No. 14), although worked with slack coal, shows the remarkably good result of 44·6 per cent. combustible and 61·4 per cent. incombustible. The gases in Nos. 10, 12, and 13 show about 38 per cent. combustible and 61 per cent. incombustible. But though the combustible ingredients have theoretically a comparatively high calorific power, the gas, as it issues from the producers, is not suitable for use in furnaces, as it carries with it a large volume of undecomposed steam, which must be removed by cooling or washing before the heat-value of the gas can be realized. Such gas is produced, therefore, only in installations which comprise cooling and scrubbing appliances, by means of which the ammonia derived from the nitrogen of the fuel is recovered.

As regards the calorific value of producer gas, without going into any figures or calculations of its amount, it stands to reason that, as such gas is produced from coal, the quantity of heat available in the gas must be less than that in the original coal by the quantity which has been required, or has become latent, in the process of transforming the fuel from the solid to the gaseous form, and for producing and decomposing the small quantity of steam used for blast purposes. As a matter of fact, the actual apparent loss of heat thus due to gas producers does not need to exceed from 9 to 12½ per cent. of the total heat of the original solid fuel. And, after all, that is not strictly a loss, for the same gasification processes (excepting, perhaps, the decomposition of the steam from a steam-jet) must go on in any coal-fired furnace, because the fuel must attain the state of gas before the existence of flame is possible. The only real loss, therefore, which is due to gas producers from this cause, is that which is represented by the difference between the temperature possible when the gases are burned at the temperature of their formation, and the degree of heat realized by burning them after they have been partially cooled by transference from the producer to the furnace.

One other source of loss of heat may be charged against the gas producer, and that is the absence of the mass of radiant solid fuel which exists in furnaces after the hydrocarbon gases have been driven off and the coal has been thoroughly "coked." This loss, however, is also more apparent than real, and, except in the case of steam-boilers, or vessels placed directly over the fire, would not be worth mentioning. In the case of the latter, it has obtained more prominence than it deserves. It really means, when examined closely, that when there is no flame the next best state of things for heating surfaces is the direct radiation to them of the heat of a large mass of glowing fuel. There can be no question that the direct contact of flame with the heating surfaces is better; and that state of matters is possible without interruption in the case of a gas-fired furnace and no other. So that the supposed loss may, after all, prove to be a real gain.

The great secret of the advantage of gas firing lies in the fact that it does away with the intermittent series of heating and partially cooling actions which make up the performance of a direct coal-fire, and substitutes for them the steady and constant application of the desired temperature. Not only do the operations of charging fuel and breaking up the fire or clinkering the grate-bars introduce cooling periods in the action of a coal-fed fire, but the sequence of the natural actions in the combustion of solid fuel, which is necessarily fed in charges, must do so likewise. And as at different states of the fire very different treatment, as to the quantity of air admitted and the manner of its admission, is required, but is almost never supplied, further fluctuation of temperature is due to this cause. The localization of the greatest heat of the fuel in the fireplace, where it is not wanted, instead of in the body of the furnace, where it is wanted, is another adverse feature of solid fuel firing. And there are often inconveniences and sources of loss, in the presence of uncombined oxygen, in the excess of air which cannot be prevented in such furnaces, which produce oxidation and deterioration of the furnace contents; and also in the presence of ashes and dust which are carried over by the draught from the fire.

Even were there no question of economy of fuel possible, the overcoming of these drawbacks would, in many cases, turn the balance in favour of gas firing, but in most instances economy is undoubted also. In the case of furnaces requiring the highest temperatures—such as for steel melting in bulk—it is safe to say that it would be practically impossible to work them without gas fuel, and, as compared with almost all coal-fired furnaces—except boiler furnaces—gas firing starts with the advantage represented by using the cheaper slack and small coal, instead of the most highly-priced varieties of round coal, or coke, no matter what degree of heat is wanted.

The great sources of saving in operating gas-furnaces are: The command of the admission of the air needed for combustion, so that the quantity in excess of the chemical requirements of combustion is cut down to a minimum; the production of the heat of combustion at the proper place in the furnace and in the best way; and the saving or arresting of waste heat in the spent gases, either by continuous or by reversing regenerators, or "accumulators," as they should be called. By bringing the air and the gas to about the same temperature prior to ignition, the greatest rapidity of combustion can be secured, and any desired temperature attained and maintained. And the lessened quantity of air which is admitted, in addition to the command of the admission of gas by means of valves, enables oxidation of the contents of the furnace to be prevented, and even a non-oxidizing or reducing atmosphere to be maintained in the furnace. Dust and ashes can also be eliminated, and the most complete circumstances of cleanliness in heating secured. When we add to all this the fact that the system of gas firing is absolutely smokeless, the marvel is that it has not long ago driven every other method out of the field of operations.

Uncertainty as to being able to realize a substantial saving of fuel in the case of boiler firing has often stood in the way of the adoption of the system, and this uncertainty has been caused simply by neglecting to observe the primary conditions of the problem of economical firing. When economy is desired, cold air can be used with producer gas only in circumstances in which the process that is being carried on in the furnace permits the accumulation of heat there. Otherwise the air, or perhaps both the gas and air, must be heated by means of the waste heat in a generator of some sort. Of all the operations of heating, that of steam-boiler firing is the one which most certainly permits of no accumulation of heat in the furnace, and yet this is the one in which cold air is most frequently employed, and the complaint of "no economy of fuel in return for the outlay" is therefore raised. This can easily be remedied, and a hindrance to the extended usefulness of the system of firing by gas will thus be removed. It is, indeed, not unlikely that at some future time the employment of gas firing may be made compulsory for industrial operations, with a view to smoke prevention in towns and areas within the jurisdiction of magistrates and county councils; and users of fuel would do well to study how it can best be applied to their particular requirements.

THE POSITION OF CARBIDE OF CALCIUM AND ACETYLENE.

An exceptionally interesting article on this subject has recently been contributed to a German periodical by Dr. Münsterberg, and "The Engineer" for the 13th ult. contained an able abstract of his views, concerning which our contemporary says: Although the opinions expressed deal more particularly with the state of affairs abroad, yet the paper is well worth most careful study. It possesses, too, a certain amount of importance from the personal aspect; for up to the beginning of the current year, Dr. Münsterberg was a Director of one of the leading German firms of carbide makers and generator builders, and when he resigned his post there was a suspicion in some persons' minds that he had abandoned the business because he foresaw no future for it. This notion Dr. Münsterberg takes the present opportunity of contradicting. Although he is no longer connected with the trade, he remains a firm believer in the gas. He considers that acetylene has already proved a success—that the gas can never be done without, and that its use has not spread so rapidly as was expected owing to over-speculation in the carbide market, and to want of capital and careful experimental work in the acetylene branch itself.

Just at present, most of the fundamental regulations governing the evolution and the combustion of acetylene have been laid down. There will only be further improvements in detail, such as more economical burners, better heating apparatus, and more practical acetylene motors. The size limit within which an acetylene installation can hope to be successful, have been discovered. The upper limit is fixed by the competition of coal gas and electricity, each of which has its superiority in ease of producing heat and power; the lower limit is at a generator supplying ten flames. The single cycle or carriage lamp is the solitary exception to this rule. It works well, because after-generation, odour, and an unsteady light are not noticed out of doors, and also because a cyclist or coachman devotes more attention to his lamp than an attendant would. An absolutely satisfactory single table acetylene lamp is not likely ever to be invented; for it is not conceivable that a chemical operation can ever be made to proceed smoothly in such a confined space. Dr. Münsterberg does not wish to be accused of placing obstacles in the way of developing the acetylene business, or he would prefer to put the lower limit in size of an acetylene installation at fifty lights.

The firm with which the author has been connected is one of the chief apostles of the "Pictet," or hand-fed, carbide-to-water system of generation. In leaving the industry, Dr. Münsterberg's predilections are still for this apparatus, in favour of which he argues at some length and with much cogency, although he is careful to admit, and indeed to insist, that there are hundreds of automatic appliances in regular operation giving perfect satisfaction. An acetylene generator has really to be considered from three aspects—its erection, its management when at work, and its size with reference to the maximum demands ever to be made upon it. The methods to be followed in the erection of a generator are already largely regulated by local or other enactments; but sufficient attention has not been devoted to the question of warming the apparatus house. Yet this is most important; for statistics plainly show that the great majority of accidents happen during periods of frost. Large installations, it is to be remarked, are likely to be better guarded against frost than small plants.

After dealing with the management of an installation, "The Engineer" abstract of Dr. Münsterberg's article proceeds to notice his contention that the price of calcium carbide may safely be taken as being a fairly permanent one. He argues that at the

German price of 25 marks per 100 kilos.—say, £12 10s. per ton—acetylene is perfectly able to meet its competitors, and is quite adapted for the illumination of towns and villages, even when its advantages on the score of cleanliness and small consumption of oxygen are overlooked. But it is important here to remember the difference there is between England and Germany. Our price for carbide is about £16 per ton, and it seems likely to remain at that figure; while our paraffin oil is distinctly cheaper. Our coal gas on an average is sold more cheaply than in Germany, and the works have penetrated into more and smaller villages in Great Britain than on the Continent. Dr. Münsterberg's prophecy as to municipal acetylene lighting may or may not be correct for us; but clearly the data on which he has based his calculation require thorough revision before they suit this country.

The second part of Dr. Münsterberg's lengthly paper treats of the carbide industry. Just as the acetylene branch, says "The Engineer," suffered from the small man and a lack of capital, so the carbide branch suffered from the financier and a superabundance of capital. Our author is no thick-and-thin advocate for the German system of close relationship between bank and factory. Sometimes the ready support given by the banks is of great assistance to industry; but occasionally, as in the present instance, it leads to a constant shifting of responsibility from the shoulders of industrialists to those of financialists, and then to those of the general public, until nobody cares much how recklessly he spends money, because it belongs to some person or persons unknown. A few years ago the colossal electrical undertakings on the Continent were, according to Dr. Münsterberg, in an unhealthy state. They were eagerly looking around for fresh business to keep their staffs employed; they heard of calcium carbide, and they rushed into the manufacture blindfold. The fall of the Bullier patent—in Germany—was a great misfortune. Had it been sustained, only a few factories would have been erected; and they would have been able to pay their way. After its fall people lost their heads, and hunted for waterfalls all through Europe, even in situations where there were no railway facilities for transporting the finished material. Many of the carbide factories have had to be shut down, few of the remainder are working at a profit; and although the syndicate, or combination of manufacturers, at Frankfort, has been of much assistance to the industry by controlling the output, it has not been able to include all the factories within its sphere of operations, and production is still excessive. How many, and which, of the carbide works will be able to survive the present competition remains to be seen; but in the meantime consumers of acetylene are profiting by the low price at which calcium carbide is to be bought. Even when the demand for carbide increases, the supply will be fully equal to it; and there does not seem any reason to imagine that the price will ever be forced up higher than at present.

ABRIDGMENTS IN CHEMICAL CALCULATIONS.

By Professor JOSEPH W. RICHARDS.

[A Paper read before the Chemical Section of the Franklin Institute Philadelphia.]

In calculating the volumes of gases produced from any weight of solid, liquid, or gaseous substance, a few simple relations render the calculations very direct. The molecular formula of a gas represents in an equation one volume, relatively, of that gas. The molecular weight represents, likewise, a relative weight. If, now, we call the total relative weights entering into a given reaction kilograms, then each molecule of gas represented in the equation will represent the volume of molecular weight in kilos. of a gas, which, by Avogadro's law, is the same for all gases. For hydrogen this volume is $\frac{2}{0.09} = 22.22$ cubic metres; and this is the volume of molecular weight in kilos. of all gases. We can, therefore, say that, calling the relative weights entering into an equation kilograms, each molecule of gas in the equation represents 22·22 cubic metres of that gas.

By similar reasoning and calculation, we can affirm the relations between the relative weights considered as grams, pounds, or ounces, and the actual volumes thus represented in litres, cubic feet, or cubic inches. We, therefore, have the following relations:—

If relative weights be	Each molecule or gas is
Kilos.	22·22 cubic metres.
Grams	22·22 litres.
Pounds	355·9 cubic feet.
Ounces	22·24 cubic feet.

(Volumes being at 0° C. and 760 millimetres.)

In the manufacture of acetylene gas

Molecules of gas = relative volumes				1		
	CaC_2	+	H_2O	=	C_2H_2	+ CaO
Relative weights	64	+	18	=	26	+ 56

Whence it follows that—

64 kilos.	of CaC_2	+	18 kilos.	of H^2O	produce	22·22 m_3 of	C_2H_2
64 grams	,, ,,	+	18 grams	,, ,,	,,	22·22 litres of	,,
64 pounds	,, ,,	+	18 pounds	,, ,,	,,	355·9 cubic feet of	,,
64 ounces	,, ,,	+	18 ounces	,, ,,	,,	22·24 cubic feet of	,,

The most complicated of chemical equations bear the application of these simple principles in a similar manner. To calculate quickly from the volume composition of a gas the weight of carbon, hydrogen, or oxygen which it will contain in unit of volume, we need only to apply the following principles.

Equal volumes of all gases contain equal numbers of molecules. Therefore, if a gas molecule of any gas whatever contains one atom of carbon, or of hydrogen, or of oxygen, we can say of such gases that equal volumes of them contain equal numbers of atoms of carbon, hydrogen, or oxygen, as the case may be, and, therefore, equal weights of each of those elements respectively.

But 1 cubic metre of CO contains 0·54 kilo. of carbon. Therefore, that statement is true of 1 cubic metre of any other gas with one atom of carbon in its molecule—such as CO_2, CH_4, &c. Gases with two atoms of carbon in their molecule, as C_2H_6, would contain $2 \times 0.54 = 1.08$ kilos. of carbon by the same principles, and so on to C_3H_8, &c. Carbonic oxide (CO) also contains 0·72 kilo. of oxygen per cubic metre. Whence a similar set of relations for CO_2, &c. Hydrogen gas (H_2) contains 0·09 kilo. of hydrogen per cubic metre. Whence it follows that 1 cubic metre of a gas with one atom of hydrogen in its molecule, as HCl, will contain $\frac{0.09}{2} = 0.045$ kilo. of hydrogen.

We can, therefore, state that for a gas containing in its molecular formula one atom of carbon, hydrogen, or oxygen, the weights of those elements present in a given unit of volumes would be—

	Carbon.	Hydrogen.	Oxygen.
In 1 cubic metre	0·54 kilo.	0·045 kilo.	0·72 kilo.
,, 1 litre.	0·54 gram.	0·045 gram.	0·72 gram.
,, 1 cubic foot	0·54 oz.	0·045 oz.	0·72 oz.
,, 1 ,, ,,	0·0337 lb.	0·00281 lb.	0·045 lb.

For a gas with two atoms of carbon, hydrogen, or oxygen in its molecule, the respective weights are twice the above; and so on for any gas, no matter how complicated. For practical calculations, I recommend keeping only the above constants in mind, and simply doubling or trebling the volume of the gas, instead of doubling or tripling the constant.

For the sake of example, calculate the weight of carbon, hydrogen, and oxygen present in 1 cubic metre and 1 cubic foot of natural gas, of the following composition:—

	Per Cent.		(By Volume).
CO_2	5·7	=	0·057
C_2H_4	0·9	=	0·009
CO	15 4	=	0·154
H_4	8·3	=	0·083
CH_2	3·8	=	0·038
N_2	65·9	=	0·659
	100 0		1·000

Calculation for Carbon.

CO_2 . . . . . = 0·057
C_2H_4 . 0·009 × 2 = 0·018
CO . . . . . = 0·154
CH_4 . . . . . = 0·038

0 267 × 0·54 = 0·1442 kilo. per cubic metre.
0·267 × 0·0337 = 0·0090 lb. per cubic foot.

Calculation for Hydrogen.

C_2H_4 . 0·009 × 4 = 0·036
H_2 . . 0·083 × 2 = 0·166
CH_4 . . 0·038 × 4 = 0·152

0·354 × 0·045 = 0·01593 kilo. per cub. metre.
0·354 × 0·00281 = 0·0010 lb. per cubic foot.

Calculation for Oxygen.

CO_2 . . 0·057 × 2 = 0·114
CO . . . . . = 0·154

0·268 × 0·72 = 0·1930 kilo. per cubic metre.
0·268 × 0·045 = 0·01206 lb. per cubic foot.

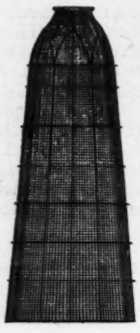
Masonic.—Members of the Evening Star Lodge and other Brethren who supported the case of Wilfred Algernon Burfield at the election for the Royal Masonic Institution for Boys last Friday will be interested to learn that the result of the first application on his behalf was a poll of 718 votes, which will, of course, be carried to his credit. In addition, Bro. Burrows, of Liverpool, exchanged 769 votes for the Girls Schools, which will come into account in the Burfield case at the next election. The lowest number of votes polled by a successful candidate was 4617; the highest, 7137.

Electrolytic Hydrogen for Incandescent Gas Lighting.—Herr O. Schmidt has proposed the employment of hydrogen, compressed in steel cylinders, to 15 atmospheres, for incandescent gas lighting with mantles. He maintains that, by the electrolysis of water, 1 cubic metre (35·3 cubic feet) of hydrogen can be obtained with an expenditure of 6·25 kilowatt-hours, which is equivalent, from the point of view of luminous efficiency, to 80 Hefner candle-hours, whereas the same energy employed for the manufacture of calcium carbide would only be equivalent in acetylene illumination to 51 Hefner-hours. This is, however, according to the "Revue de Chimie Industrielle," too low, and 80 Hefner-hours in this case also would, it is considered, be nearer the truth. The cost of plant for a carbide works might bring down the scale in favour of the process, provided the distance from the factory to the consumer was not too great, so as to avoid excessive tariffs for the carriage of the cylinders of compressed hydrogen.

REGISTER OF PATENTS.

Incandescent Lighting Bodies.—Meyer, G., of Prague, Austria. No. 19,859; Nov. 5, 1900.

In explanation of his proposal, the patentee remarks that, in order to strengthen incandescent mantles, and render them resistent to external mechanical influences, attempts have been made to impregnate them (the whole hose-shaped fabric aided in some cases by the insertion of strengthening threads) with suitable salts and acids. These methods were, however, soon abandoned, as it was found that the incandescent bodies had to be so strongly impregnated that, although rendered less susceptible to external mechanical influences, this was effected at the cost of their illuminating power.

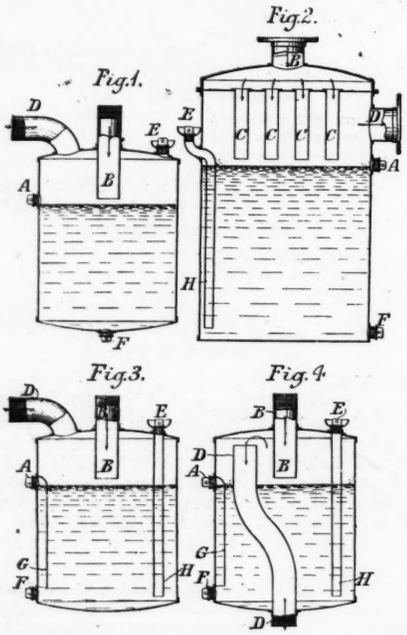


In order to avoid this drawback, the patentee's suggestion consists essentially (as shown) in firmly attaching to the mantle a stiffening rib—or rather a stiffening lattice or framework formed with longitudinal or cross ribs, somewhat like a honeycomb—which is knitted, sewn, or netted on the incandescent mantle. The stiffening rib—formed of animal, vegetable, or mineral fabrics or fibres—is previously impregnated with certain (preferably, silicic) acids, which have the property, when the mantle is subjected to treatment in a gas-flame under pressure, before the mantle is used on a lamp, or when exposed to a high temperature, of being changed into a vitrified or solid fire-resisting condition.

If a mantle made in this manner be lit up, it will be noticed, the patentee remarks, that "the incandescent body, divided into spaces by means of the lattice arrangement, not only in a short time thoroughly combines with the latter, but is also strengthened in such a way that it can without damage withstand great shocks; while the illuminating power of the incandescent body does not suffer thereby."

Extracting Naphthalene from Gases.—Breittmayer, L., of Bordeaux. No. 10,024; May 14, 1901.

This invention relates to apparatus "for recovering the naphthalene contained in illuminating and heating gases without injecting it into the naphthalene-dissolving fluid, and consequently without diminishing the gas-pressure to any appreciable degree. To this end, the gas from which the naphthalene is to be recovered, is directed vertically or obliquely and very near the surface of the dissolvent, where it is then deflected and spreads out, depressing the surface by creating a pressure on it, so that the denser particles of the dissolvent—such as those that have become impregnated with naphthalene—are forced to the bottom of the dissolvent container, and the lighter particles, less contaminated with naphthalene, rise to the surface again, where they come into contact with the gas, which is streaming into contact with the surface."



Various forms of apparatus constructed according to the invention are shown in the engraving. They consist of enclosed water-tight vessels containing the naphthalene-dissolving fluid up to a level determined by the plug A. The gas from which the naphthalene is to be extracted is supplied through a nozzle B (figs. 1, 3, and 4), or by a set of nozzles C (fig. 2), into the vessel. The gas, entering at normal pressure in the direction of the arrow, impinges on the surface of the fluid, and depresses it in such a manner that the gas comes into contact with a large surface of the fluid and agitates it—making the lighter particles of the dissolvent rise to the surface, and precipitating the denser particles impregnated with naphthalene to the bottom of the vessel. The denaphthalized gas escapes through the pipe D, which may pass down through the liquid (fig. 4) or not.

The vessel is provided with a replenishing plug E (screwed into the bottom of a funnel) and a drain plug F. These accessible elements are for filling the vessel with the fluid, and drawing it off when impregnated with naphthalene. The plugs may be connected to immersed tubes G H; the object being to prevent any escape of gas through the plugs, if by inadvertence they should not be screwed in.

The denaphthalizing agent employed is "any dissolvent of naphthalene, such as carburetted hydrogen in the form of benzine or benzol, the heavy oils from coal, oils of anthracene, essences, purified oils, and heavy oils of petroleum. The dissolvent may be of a volatile nature (and thus simultaneously serve to enrich the gas) or it may be non-volatile, and only serve to dissolve the naphthalene contained in the gas."

The apparatus is to be placed either at the base of the pipes leading to the burners, or at the junction of the branches leading from the mains to the consumer's house, or immediately before the delivery to the consumer's meter.

Bunsen Gas-Burners.—Walker, M. S., of Chicago, U.S.A. No. 15,139; July 25, 1901.

This invention relates to gas-burners of the bunsen or colourless-flame type, whether used in the simple laboratory form for heating, or in combination with incandescent mantles. The object desired is "to provide such burners with a mixing-device adapted to effect a more perfect combination of air and gas than is attainable in the use of the ordinary bunsen burner; the purpose being to increase the heating capacity of any burner, operated under any given pressure of gas."

In the laboratory burner, this means simply that the heating capacity of the burner is increased; whereas with the incandescent mantle burner, it means that a given burner, operating under a given gas-pressure, will heat to complete incandescence a larger mantle than can be equally heated by the same burner not provided with the improved mixing device.

To attain this, gas from a suitable source of supply is delivered under pressure through a small orifice (preferably in the form of a small tubular nozzle), thereby forming a swiftly moving jet, and whereby also the jet thus formed is passed through a second limited opening—preferably tubular—so that the jet of gas operates on the principle of an injector, with the result that air is drawn toward the jet of gas, and is carried with it through the second orifice, the gas and air being thereby thoroughly mixed. This device (which may be called a primary mixer) may deliver the mixture of air and gas so formed into a tube open only at its ends, and having no function but that of a channel for the air and gas. But the patentee prefers to combine the primary mixer with the ordinary mixing-tube of a bunsen burner provided with openings subject to regulation, whereby the air and gas from the primary mixer may receive, in the mixing-chamber, a suitably regulated further supply of air, before reaching the point at which combustion takes place.

The invention is illustrated in various forms in drawings accompanying the specification; but the forms so shown are "merely suggestions of certain differences of construction coming clearly within the invention," and the patentee has not attempted to show all the various forms which might be devised without departing from the invention.

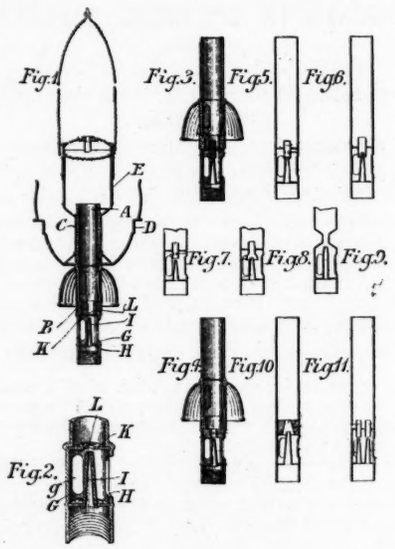


Fig. 1 is a central longitudinal section of a burner of the incandescent mantle illuminating type, provided with a primary mixer; fig. 2 is a central longitudinal section of the mixer alone (to a larger scale); fig. 3 is a central longitudinal section of a bunsen tube provided with the primary mixer modified in construction, as compared with figs. 1 and 2; fig. 4 is a similar view of the bunsen tube provided with the primary mixer in another slightly different form; and figs. 5 to 11 are diagrammatic sections of tubes provided with the primary mixer in various forms of construction.

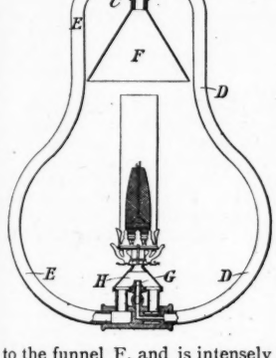
In fig. 1, A is the tube of an ordinary bunsen burner formed with openings near its lower end; the part of the tube so perforated being encircled by a sleeve B, having openings which may be brought into or out of registration with the openings in A by rotating the sleeve. On the upper part of A is a second sleeve C, carrying at its lower end the usual chimney-support D, and at its upper end the tubular gas-chamber E. The upper end of the chamber E is provided with wire gauze diaphragms, such as are ordinarily used in burners of this type; and the mantle is supported above the chamber E in any suitable way.

so that its lower end encircles the upper end of the chamber E. So far as all these details are concerned, they correspond to the ordinary construction of illuminating burners of this general type; and they are only shown for the purpose of illustrating the application of the improvement to a burner of this class. In the use of such burners heretofore, it has been common to supply gas to the lower end of the mixing-tube of the bunsen burner, by means of a tip screwed to the gas-fixture and screwed into the lower end of the bunsen burner tube; one usual form of such tip being that of a tube having at its upper end a flat disc formed with a series of small perforations—the gas being delivered through these perforations directly into the tube of the bunsen burner, and there mixed with air entering the lateral openings in the tube It will be seen, however, that in the apparatus shown in fig. 1, the ordinary mixing-tube of the bunsen burner is supplemented by the device shown in that figure and also in fig. 2, in which G is a mixing-tube formed with openings for the admission of air, and internally screw-threaded (at its lower end) for attachment to a gas-fixture, and externally screw-threaded at its upper end for engagement with the lower end of the tube A. In the mixing-tube G, below the opening, is a diaphragm H, which supports a tubular nipple I, set at its lower end in the diaphragm; and immediately above the upper end of the nipple is a second diaphragm K, set in the tube G, and having at its centre a small opening L, which is preferably concentric with the opening of the nipple I. Thus any gas delivered to the burner must pass through the nipple I, and form a jet moving at a considerable speed through the orifice L, in the diaphragm K. In its movement, the jet will draw inward, and carry upward, a constant supply of air entering the tube G; and as the air so drawn inward towards the jet of gas moves upward with it, the air and gas is mixed, and the mixture delivered to the chamber within the tube A—that is, to the ordinary mixing-chamber of the bunsen burner.

The patentee has found, by experiment, that the mingling of air and gas effected by this primary mixer "greatly augments the efficiency of the burner operating under any given pressure of gas, and that in many cases the mixing so effected is sufficient for all practical purposes, without any further addition of air." He prefers, however, to deliver the mixed air and gas from the primary mixer into the perforated tube of the bunsen burner, in order to provide for the admission of a further supply of air capable of suitable regulation, whenever such further admission of air is found necessary or desirable.

Regenerative Gas-Lamps.—Hoffmann, P. C. F., of Altona, Germany. No. 15,351; July 29, 1901.

In a regenerative gas-lamp, according to this invention, the heat of the flame is utilized for drawing in atmospheric air and heating it; the heated air being thereupon drawn into the nozzle of the burner by the issuing gas and intimately mixed with the gas before combustion takes place.



A is a junction-piece provided with two passages B and C. To B is connected a gas-pipe D, and to the other an air-pipe E. The latter passes from the funnel-shaped collector F, placed above the flame, to a chamber H, which is open at the top and arranged around the burner G. In this chamber, the gas and the hot air are intimately mixed together.

The action is as follows: The heat of the flame rises in the collector F and heats the air under it, which is immediately drawn in by the gas issuing from the nozzle G when the burner-cock is opened. The products of combustion have an aspirating action, so that a large quantity of air is supplied to the funnel F, and is intensely heated; while a portion of the products of combustion are drawn in with the air sucked in, so that the products of combustion (or a large portion of them) are "burnt again, resulting in a considerable saving of gas."

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19,502.—Schapiro, A., "Incandescent burners." Sept. 30.
19,548.—Machin, T., and Gregory, A., "Acetylene generators." Oct. 1.
19,558.—Breeden, J., & Co., Ltd., and Breeden, F., "Gas lamps, chandeliers, and brackets." Oct. 1.
19,564.—Edwards, E., "Gas or other engines." Oct. 1.
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19,633.—Brier, H., "Gas-compressors." Oct. 2.
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19,671.—Wien, H., "Incandescent gas-burners." A communication from H. C. Löroy. Oct. 2.
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19,826.—Abel, C. D., "Purifying gases." A communication from J. Saltar, jun. Oct. 4.
19,855.—Glover, R. T. & J. G., "Coin-freed mechanism." Oct. 4.
19,857.—Powers, V., and The Bevois Patent Lighting Company, Ltd., "Generation, storage, and purification of acetylene and like gases." Oct. 4.
19,858.—Strakosch, M., "Lamp adapted to burn acetylene gas or petroleum and other hydrocarbons." Oct. 4.
19,898.—Thompson, W. P., "Utilization of gas for industrial purposes." A communication from J. H. Darby. Oct. 5.
19,909.—Boult, A. J., "Gas-generators for internal combustion motors." A communication from L. Inchauspé. Oct. 5.
19,916.—Blake, J. P., "Incandescent gas-burners." Oct. 5.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Income-Tax Assessment—Allowances for Wear and Tear.

Sir,—It appears to me that your correspondent Mr. Sprague is on a vain quest, if he expects to find any gas undertaking which has an allowance made in its assessment for the depreciation of service-pipes and meters, in addition to the amounts entered for current repairs in the revenue account of each year.

The difficulty of getting a proper and fair allowance for wear and tear of machinery and plant does not arise so much with regard to retorts, meters, stoves, services, lamps, and other plants of small dimensions, as with the larger and more costly portion—such as retort-benches (apart from retorts), scrubbers, purifiers, gasholders, mains, &c. The former can be maintained in a state of efficiency by repairs and renewals year by year; but the latter suffer depreciation which cannot be made good in the same manner. A time comes with each portion of the larger plant, when it can be no longer repaired or patched up, but has to be entirely renewed. Its cost is much too large an item to be debited to a year's revenue account. For this renewal, the user of the machinery and plant should have an allowance made in the assessment of his profits for income-tax. Such an allowance is made in assessing for the poor-rate.

My Company are making a claim for the depreciation referred to, over and above the amounts charged in the revenue account for repairs. The local Surveyor of Taxes has disallowed the claim, and has not even allowed anything for depreciation of gasholders, which I learn from your correspondent's letter has been allowed in his case. We are therefore appealing, and asking to be heard by the Commissioners for Special Purposes.

Why the Somerset House authorities draw the line at gasholders, and disallow on other portions of the plant which are alike in character, is past understanding. What essential difference is there (except in cost) in having to renew a set of purifiers and to renew a gasholder? They both occur at long intervals of time. They cannot well be effected piecemeal, but have to be undertaken in their entirety; and both involve considerable outlay of money. The same principle in providing for depreciation should apply to both alike. It is true, when these renewals take place they are generally accompanied by enlargement of the plant; but this does not alter the fact that the original outlay upon it is of no further service.

Could not the Gas Companies' Protection Association take up a typical case, and see it through, and obtain for gas companies the relief they are entitled to?

Malton, Yorks., Oct. 11, 1901. Henry Tobey.

LEGAL INTELLIGENCE.

Charge of Stealing Gas.

At the West London Police Court on Saturday, a young man named Henry Valentine Mendelssohn Hill, who carried on the business of a hairdresser and tobacconist, in Wandsworth Bridge Road, was charged with stealing gas from the Gaslight and Coke Company. Mr. Humphreys prosecuted. The evidence was to the effect that the prisoner had been a customer of the Company continuously since November, 1898. In consequence of the consumption of gas having been found to be greater than usual, a fitter made a surprise visit on the 1st inst., for the purpose of examining the meter. He was taken into the cellar by a man who stood with his back to the service-pipe and his arm over the meter. The fitter, after striking a match and reading the index, turned to quit the cellar, followed by the man. Having his suspicions aroused, however, he returned to the cellar and struck another match. He then found that the customer's pipe and the Company's service pipe had been disconnected from the meter, and a temporary connection made, allowing a supply to be procured without the gas passing through the meter. Gas was found burning under the water-urn in the shop, and the fitter was able to light one of the incandescent burners. The piece of pipe forming the temporary connection was produced, and the witness expressed the opinion that it was some months old. Mr. H. I. Watson, Senior Inspector, said on the day following the fitter's visit he went to the premises, and found that the Company's pipe supplied eleven lights, including three outside, as well as a ring boiler in the kitchen and a gas-engine in the washhouse. There were eleven switches to supply electric light in the shop. It was explained by the witness that it was a 5-light meter, supplying 30 cubic feet of gas per hour. Through the temporary pipe, the supply would at least be 150 cubic feet hourly. The next day the prisoner called at the office, and, on being asked for an explanation, said he was sorry for the mistake, but, finding an escape on the previous Sunday evening, he sent for the gas-fitter, who disconnected the meter, and put on the pipe. He said the supply to the engine was an exaggeration, as the quantity stated would never be used for a half-horse power engine. Mr. Watson was questioned on this point, and said the engine furnished 2½-horse power with 50 cubic feet of gas per hour. It was stated by the witness, who put the engine up about twelve months ago, that he mentioned it was usual to have a meter for it. Mr. Rose remanded the prisoner, and allowed bail.

Newcastle and Gateshead Gas Supply.—An official statement, just issued by the Newcastle-upon-Tyne and Gateshead Gas Company, shows the enormous increase which has taken place in the sale of gas by the Company in the past ten years. In 1890, they sold 1,540,194,000 cubic feet; and there has been an advance each year since that time. The sales for 1900 reached 2,598,981,000 cubic feet; and there were then no fewer than 41,179 customers. The sales have thus increased in the ten years by more than 68 per cent.

MISCELLANEOUS NEWS.

INCANDESCENT GAS LIGHTING IN NEWCASTLE-ON-TYNE.

Electric Lighting Displaced.

We learn from the Newcastle papers of the 10th inst., that the Lighting Committee of the Corporation have just made an important departure in connection with the public lighting of the city. Some time ago, three of the principal streets—Neville Street, Grey Street, and Newgate Street—were lighted by electric arc lamps. There were also three round Grey's Monument, and two at the open space at Barras Bridge, near the Museum. Not quite two years since (as recorded in the "JOURNAL" at the time), the arc lamps round the monument were removed, and 24 incandescent gas-burners installed in their stead; and more recently those at Barras Bridge have given place to two incandescent gas-lamps similar to those erected on the Odense Boulevard, which were illustrated in the "JOURNAL" for May 2, 1899. The latest step in the development of the incandescent system is its adoption for Grey Street, the lighting of which has always given trouble. The character of the thoroughfare has greatly changed in the past decade; and the tradesmen and occupiers of offices attribute this in no small measure to its inefficient illumination. Some years ago, an appeal was made to the Corporation to light the street by electricity instead of gas; and this was agreed to. Arc lamps were erected; but, in the language of the "Newcastle Daily Leader," they "have been a failure. Their dull blue lights, only 'make darkness visible,' and have earned for them the title of 'blue-bottles.'" The result has been more grumbling, which culminated in an influential deputation waiting upon the Corporation rather more than a week ago to see if some improvement could not be effected. The matter was referred to the Lighting Committee, who promised to pay a visit to the street. They were evidently impressed with the justness of the complaint made by the deputation, for at their meeting last Wednesday they decided to light the thoroughfare by incandescent gas-lamps, and do away entirely with the electric light. There will be 19 new lamps, in addition to the existing 10, each having two burners; the total illuminating power being 7200 candles, against the present 4300 candles. The most satisfactory feature of the change, from the ratepayers' point of view, is that, it will furnish this additional light at a saving of between £45 and £50 per annum.

GAS MANAGEMENT AT WIDNES.

Widnes is naturally proud of the position it occupies of being supplied with the cheapest gas in the world; and the Corporation feel not a little gratification at the possession, in their Gas and Water Engineer (Mr. Isaac Carr, M.Inst.C.E.), of a man whose skilful management has brought the town into such prominence. The ratepayers, too, are doubtless appreciative of the advantages they enjoy as the result of the exercise of this skill. At the same time, it is useful to recall to their minds the progressive steps by which these advantages have been secured. This has been done in an article in the last number of the "Widnes Guardian," from which we make a few extracts. The writer, who interviewed Mr. Carr, begins by pointing out that in the early eighties the Widnes Gas-Works were only of the ordinary type. It was then that a thorough and far-reaching reform was commenced; and, after nearly twenty years' work, everything has been put on a modern basis. In the same time the cost of producing gas, while paying a fair Trade Union rate of wages to the workmen employed, has been reduced practically to the minimum. The steady progress of these twenty years is very well marked by the prices charged: In 1881, they were 3s. 6d. and 3s. 11d. per 1000 cubic feet; in the next year, they fell to 2s. 9d. and 3s. 6d. By 1888, a marked reduction had been made; the prices being 1s. 10d. and 2s. In 1893, they went down to 1s. 8d. and 1s. 10d.; in 1897, they were 1s. 6d. and 1s. 8d.; and in 1899 a further reduction took place, bringing the figures to 1s. 5d. and 1s. 7d. With the exception of the three years 1889-1891, a profit has always been shown; and the small deficits in these years were caused by alterations at the works. Gas used for motive power is supplied for less than 1s. 5d. per 1000 feet, notwithstanding the high prices of gas coal. The writer goes on to show how the economy which allowed of these successive reductions was effected. It is unnecessary to repeat here the details of the manufacturing processes adopted from time to time by Mr. Carr. It is sufficient to record the fact that they have enabled him to bring down the net cost of making and distributing gas from 9d. to 6·142d. per 1000 cubic feet. In 1881, the year preceding his appointment, when residuals were worth more than double their present value, the cost was 1s. 2·2d.

Turning to the subject of public lighting, Mr. Carr expressed the opinion that in the adoption of electricity for this purpose towns and their authorities were ill-advised; and he supplied figures in regard to nearly all the municipal electrical undertakings, which proved that only in exceptional cases were the returns of such undertakings profitable. An interesting piece of information relating to the comparative cost of electricity and gas for motive power purposes was given by him. Taking gas as supplied at Widnes for power, at 1s. 1d. per 1000 cubic feet, he stated that, in order to compete with this price, electricity would have to be supplied at ¼d. a unit. In proof of this, he pointed out that a Crossley gas-engine would give one brake horse power for every 15 cubic feet of gas consumed. Consequently, if 1d. purchased 77 feet of gas (1s. 1d. per 1000 feet), the result would be that the gas-engine would give 5 brake horse power for 1d., and there would still be 2 feet of gas to the good. In order to obtain an equivalent with electricity, each unit of electricity being equal to 1·33-horse power, it would be necessary to supply electricity at ¼d. per unit. The cheapest rate at which electricity was now provided for power purposes is a fraction over 1d. per unit; and it would, on the present means of production, be impossible to sell it at less cost, since it was not supplied at this sum without loss, and much less would it be possible to equal the cheapness of Widnes gas with electricity, either or lighting or for power purposes.

THE NEW MUNICIPAL GAS-WORKS AT ZURICH.

Results of the First Year's Working.

Most of our readers will probably remember that the early numbers of the last volume of the "JOURNAL" contained an illustrated description of the new gas-works of the Municipality of Zurich. Supplementary thereto, it may be of interest to give the results of the first year's working of the new plant, which we are able to do from an article prepared for our contemporary the "American Gaslight Journal," by Mr. Walter S. Allen, of New Bedford (Mass.), and contained in the number for the 30th ult. They are from the annual report, and are as follows.

During the year, retort-stack No. 1 was run the whole time, and No. 2 a portion of the time; being thrown out occasionally to bring into use Nos. 3 and 4. This was done to test the De Brouwer coke-conveyor; and the results were so good that it has been decided to put in the same machinery for stacks Nos. 1 and 2. The advantages which have been obtained by the mechanical handling of material are best shown by the results secured per mouthpiece per day. The production, which in 1897 was 7723 cubic feet, rose last year to 9885 cubic feet; and this increase in production was accompanied by a decrease in the amount of coke used in the generators and in the charge for labour.

The following table shows the results of the last two years:—

	Gas Made. Cub. Ft.	Working Shifts.	Gas per Shift. Cub. Ft.	Retort Days.	Gas per Retort Day, Cub. Ft.
1900	465,443,700	11,997	38,797	47,086	9885
1899	423,142,900	12,775	35,043	48,955	9038

This output of nearly 39,000 cubic feet per shift compares with an output of 20,200 cubic feet from the old works in 1897, and this notwithstanding the fact that during the year the quality of the coal was not of the best. As compared with the previous year, the cost of materials (coal and enrichers) increased 2·4d. per 1000 cubic feet, but labour decreased from 3·55d. to 2·4d. per 1000 cubic feet.

The material used was 47,166 tons of coal, 330 tons of boghead, and 103 tons of benzol (equal to about 28,000 gallons). The production per ton of materials gasified was 9780 cubic feet of gas, 1461 lbs. of coke, 124 lbs. of tar, and 16 lbs. of sulphate of ammonia. The coke used in the generators was 220 lbs. per ton of coal carbonized, against 279 lbs. in the previous year. It was found possible to keep up the heats by clinkering only once in 48 hours—the grates being cleaned every 2 hours; and for this reason there was a saving of labour.

The distribution of the gas sold was as follows: Total sales, 443,252,700 cubic feet, an increase of 11·76 per cent. over the previous year; gas for public lighting, 79,236,300 cubic feet; for private lighting, 135,765,600 cubic feet; for cooking and heating, by separate meters, 163,150,200 cubic feet; for gas-engines, 25,091,600 cubic feet; to the North-Eastern Railway, 21,509,100 cubic feet; to the public buildings, 17,483,100 cubic feet; for a balloon, 190,700 cubic feet; supplied outside the city limits, 826,100 cubic feet; used at works and offices, 3,745,500 cubic feet; unaccounted for, 17,580,100 cubic feet, or equal to 3·83 per cent. The gas used for cooking and heating increased 20·67 per cent. during the year, and exceeds that employed for private lighting by more than 27,000,000 cubic feet. The number of engines supplied was 186, with 1227-horse power.

The number of public lamps was 6625, of which 3596 were incandescent. These last used an average of 3·7 mantles and two chimneys per annum. The minimum illuminating power of the gas supplied was 11·4 candles, the maximum 17·1 candles—an average of 13·7 candles, according to the tests made by the city; the tests at the works averaging rather more than 1 candle higher. The number of meters in use on Dec. 31, 1892, was 3714; on the corresponding dates of 1898 and 1900, 16,137 and 19,689 respectively. These meters were divided as follows:—

	1892. Per Cent.	1898. Per Cent.	1900. Per Cent.
For lighting gas	87·7	50 8	45 5
,, technical gas	2·8	1·1	0·9
,, motor gas	0·6	1·2	0·9
,, cooking and heating gas	8 9	46·9	52·7

The price charged for gas used for lighting is 5s. 11d., and for cooking, &c., 4s. per 1000 cubic feet; but two burners for light are allowed on every meter for cooking and heating gas, and three more lights may be attached by payment of a small fixed sum, amounting to about 4s. per burner per annum.

INCANDESCENT TRUST, LIMITED.

Mantles and Fittings Dealers on their Position.—Refusal of Interim Injunctions against Sellers of Certain Mantles.

In the "JOURNAL" for the 1st inst., there appeared a paragraph dealing with the affairs of the above Trust; and in it reference was made to rumours of a schism among the leaders. There was also an allusion in it to the "statutory meeting" of the organization, which was convened by the "Directors," Messrs. Lowen, Edge, and Mellor. At that meeting the Press were rigorously excluded. It came somewhat as a little surprise to receive a day or two later a notice, signed by three "Councillors" of the Trust, calling a meeting for last Thursday, at the Three Nuns Hotel, Aldgate High Street, for the purpose of considering a resolution—"That Messrs. S. J. Rising, J. Stein, and J. Boehm be appointed Directors, to fill the places vacated on the Board by the request of the Council in accordance with a resolution, dated the 17th day of September, 1901." That was the specified object of the meeting; but the resolution merely formed a base on which to review and condemn past procedure, to show cause for increased activity in the future, and to come to resolutions for united action and support. The rumours as to the division received ample confirmation; and the explanation regarding the circumstances will be gathered from the following digest of the proceedings.

The chair was taken by Mr. J. Altman, who began by appealing

for a peaceful discussion. He then alluded to the meeting held at the Cannon Street Hotel in April last, for the purpose of considering as to what action should be taken in connection with the pressure under which the incandescent industry was working in this country. The outcome of the meeting was the establishment of a Limited Liability Company under the title of the Incandescent Trust, with a capital of £15,000. When the prospectus was issued, there were more shares applied for than the number mentioned on the document; and so the Company went to allotment. By the Articles of Association, supreme power was vested in the Council, because it was not known when the Company was established whether the Directors would be drawn from the trade or from outside it. Therefore care was taken to have a Council of tradesmen, whose instructions the Directors were to follow; and nothing was to be done by them without the consent of the Council. The Chairman was sorry to say that the Directors did not comply with the Articles in this respect. Consequently, on Sept. 17, the Council had a meeting at which they resolved to request the Directors to resign. This power was given to the Council under Clause "*g*" of Article 121. Notwithstanding this, the Directors called the statutory meeting of the Trust; but this was illegal, as on Sept. 18 there were no Directors. At that meeting, commissionaires were posted at the door; and admission was refused even to shareholders who had fully-paid shares. This injustice would, he thought, do a lot of injury to those concerned. The present meeting was thereupon called to elect three new Directors. He (the Chairman) was of opinion that the Trust was the best move that the dealers had ever made in the incandescent industry of this country, because everybody knew how absolutely they were crippled. The Welsbach Company said they had a monopoly, and forced rules and restrictions upon everybody. They said: "You must not use our mantles on other burners; and you must not do this or that." Yet there were any number of improved burners to be had, which would give an illuminating power of 180 candles, with a consumption of 6 cubic feet of gas an hour, without complicated machinery or the use of compressors. But the dealers could not freely give to the public, at a low cost, a good and valuable article for a powerful light, because the Welsbach Company said, "You infringe our 1893 patent." This being the position, the incandescent industry was suffering. They had good burners, chimneys, adapters, fittings, and all such things; but there came in the question of the mantle. For the present state of things he blamed a little the patent system of this country. Under the 1885 and 1886 patents, Welsbach claimed everything—rare earths and rare metals; and under those patents, he prevented mantles being made. Then came the 1893 patent; but that was not accepted in Germany or America, where there is a searching system. They could put the trade on a sound footing if they only went hand in hand. If everybody paid his calls, the Council and the new Directors would be able to get things in better order; and the first test case would be fought fairly once and for all. The Trust was only formed, as everyone knew, for one purpose, and that was to test the validity of the 1893 patent. A letter was than read by the Chairman which was addressed to the late Directors by their Solicitor (Mr. J. B. Purchase), in which he recognized the power of the Council, and concluded by saying: "I really think that my original opinion, to the effect that the Directors should resign, should be carried out, as I am very much afraid the Directors might find themselves involved in litigation, which would, to say the least of it, be exceedingly unpleasant, and might prove expensive." In his concluding remarks, the Chairman gave a general invitation to mantle manufacturers and the trade to join the Trust, and help it financially and with good motive.

A point was raised by Mr. Walter Lowen as to the legality of the meeting. He asserted that the notice was dated Oct. 3; and therefore the requisite full seven days' notice had not been given. The Chairman was of the contrary opinion; but Mr. Lowen signified his dissent by withdrawing from the meeting, being accompanied by Mr. F. Edge, another of the late Directors.

Further comment was made, and information given, on the late internal troubles of the Trust by Mr. A. Allwright; but we have already reported sufficiently on them. Then he passed on to allude to the threatening of customers by the Welsbach Company. On this point, he referred to the decision of the Lord Chief Justice on Tuesday to the effect that the Welsbach Company have no right to ask for interim injunctions against mantle sellers where the mantle in question is the subject of pending litigation. If, he remarked, they had had a pronouncement of this kind a few months ago, how different the position of the trade would have been at the beginning of the present season. What the Trust wanted was a Board that would look after the interests of every one of the members, and defend all of them against the litigation of the Welsbach Company. In a few days the Council would draw up, and submit to the members, a scheme that, he believed, would give satisfaction to all. He was convinced they would bring in quite enough members to provide ample funds for the carrying on of their object in the future.

Replying to a question, the Chairman stated that the balance of the funds of the Trust was quite safe. At the time they asked the Directors to resign, a letter was written to the bank to stop further payments. The bank were quite satisfied that by the Articles of Association the Council had power to do this.

The next speech was by Mr. H. Ogus; and he also largely directed his remarks to the past management of the Trust. He strongly condemned the change which was made in the Solicitors to the Trust—from Mr. Jonathan E. Harris to Messrs. Purchase on the advent of Mr. Lowen to the Board. He then gave his views on the wants of the Trust, in order to improve its usefulness in the future—placing in the fore the need of Directors who would work for the general benefit of the members, and not for their self-interest, and a manager and secretary who knew the business thoroughly and the course of the particular litigation in which they were interested. Unity between the Council and the Directors was also essential. Passing on, Mr. Ogus read a letter from Mr. Harris, the Solicitor of the Perfect Mantle Company (of which Mr. Ogus is Manager), announcing the decision of the Lord Chief Justice refusing the granting to the Welsbach Company of interim injunctions against sellers of the mantles of the Guaranty, the General, and the Perfect Incandescent Companies; and this the Chairman afterwards characterized as one of the finest successes they could have had. What was wanted now, he added, was the test case in the High Court.

Then there was further discussion, in which Mr. Whitle, Mr. Mundler (the Acting Secretary), and the Chairman took part. In the course of it, the Chairman made it perfectly clear that the Trust would protect, in litigation affecting the 1893 patent, any of its members without distinction as to the mantle in which they were interested. He thought there was a probability of a test case coming on in November or December.

A little advice was given by Mr. Thompson, of the General Incandescent Burner Company, as to the necessity of securing a return of the favour of the public, and to make the Trust a big trade combination. He also declared that it had come to his knowledge that two of the shareholders were in the employ of the Welsbach Company. Among Mr. Thompson's other statements was one that he had it on good authority that the Welsbach Company's Solicitors in Edinburgh had written to a big Corporation, asking for the names and addresses of all persons from whom they (the Corporation) had bought burners and mantles, for an account of all "infringing" mantles, &c., so bought, and requesting the payment to the Welsbach Company of 5s. on each burner and 7½d. on each mantle.

Then the meeting turned seriously to the question of electing three Directors. Mr. Stein's time being limited, he asked to be excused from serving; and Mr. Rising being absent, the members did not feel they would be justified in electing him without his consent. Ultimately, Mr. Whitle, Mr. Boehm, and Mr. Thompson were elected. With promises by Councillors and Directors to do their best in the interests of the subscribers, the meeting (which had lasted only a little short of two hours) terminated.

TRADE UNIONS AND THE TAFF VALE JUDGMENT.

Opinion of Counsel.

At the recent conference of the Miners' Federation in Birmingham, Mr. B. Pickard, the President, intimated that Counsel's opinion had been taken with regard to the position of Trade Unions in view of the judgment of the House of Lords in the Taff Vale case. Mr. Atherley Jones, K.C., M.P., was the Counsel referred to; and the points raised were as follows: Who is an agent? Who is an official? What personal act brings the Association into direct collision with the law? Where does the liability of the Association come in for an act of an agent or an official so that the Trade Union funds are attackable; and what act, if any, constitutes a breach of the law which makes the Union amenable for such acts? How comes it about that this law of Trade Unions has been in existence for about thirty years, and now a new rendering has been given to the point of suing and being sued by third parties other than for work done? How does the decision affect registered and unregistered Trade Unions? Can Trade Unions sue under this decision for contributions and levies laid according to the rules? Mr. Atherley Jones, in his reply, states that, in accordance with the decision in the case in question, it is now finally established that a Trade Union is liable for the wrongful acts of its servants or agents committed in the course of their services, and purporting to be for the benefit of the Union. He proceeds to say that it is not material to liability whether the Union is registered or unregistered. If it is registered, it can be sued in its registered name; if not, it can be sued in the name of its representative members, and, for the purposes of reaching its funds, trustees added as parties. The most usual cases in which a Trade Union may be liable for the wrongful acts of its servants or agents is in respect of what may be done by them in relation to a strike or lock-out. By the Executive Committee and the chief officers of a Trade Union very responsible functions as to the initiation of strikes or their control or supervision are performed; and an act of intimidation by an official who was permitted to exercise control or management of a strike, even though it were expressly forbidden to intimidate, would render the Union civilly liable for damages resulting to any person from such intimidation. On the other hand, if the person were solely employed by the Union—for instance, to keep the accounts committed to his charge—and did acts of intimidation without receiving any instructions to do them, he would not render the Union liable. With regard to officers of branches, Counsel is clearly of opinion that, though a wrongful act by them in the course of their employment might bind the branch and the funds, if any, their acts, unless expressly authorized, could not bind their Trade Union. In the first place, an act must be a wrongful act—that is, one for which a person committing it would be himself criminally and civilly liable. Since the passing of the Conspiracy Act, persons cannot be punished criminally for committing or agreeing to commit an act in furtherance of a trade dispute, unless such an act is in itself a crime. Counsel enumerates acts to which civil responsibility attaches. False or fraudulent representations to the injury of an employer, violence or threats of violence, besetting premises in such a way as to cause disorder or intimidation, or reasonable fear of disorder or intimidation, undoubtedly afford a civil remedy. He is also of opinion that the disability imposed by section 4 of the Act of 1871 is not affected by the Taff Vale case; and a Trade Union cannot, therefore, sue its members for contributions or levies.

Land for the Leeds Water-Works Extensions.—Mr. Edwin Gray, the Under-Sheriff of Yorkshire, and a Special Jury, sat last Thursday and Friday at the Prospect Hotel, Harrogate, for the purpose of assessing the amount of purchase-money to be paid by the Leeds Corporation to Mr. John Cunliffe Kay, of Canterbury, in respect of the compulsory acquisition from him of lands and buildings situate in the Washburn Valley, required for water-works purposes. The property in question consists of three farms, and comprises an area of about 147 acres, together with a one-sixth share in Swinsty Moor. Mr. W. J. Waugh and Mr. Mason represented the claimants; Mr. Balfour Browne, K.C., appeared on behalf of the Corporation. The valuer employed by Mr. Kay assessed the property at £13,256; while the Corporation's estimate was £6416. The Jury viewed the farms on Thursday, and at the close of their inquiry awarded £7900.

BRADFORD CORPORATION GAS SUPPLY.

Purchase of the Airedale Gas Company's Works.

When the Bradford Extension Order was granted, conditions were attached to it by which the Corporation agreed, as soon as they could, to purchase the necessary gas undertakings to place the whole of the added areas on the same footing in regard to the price of gas as the remainder of the city. Arrangements have already been concluded for the purchase of the Clayton Gas Company; while the Shipley Company's undertaking was provided for by the Shipley Council's Bill of this year. Final arrangements have now been made (subject to the confirmation of the City Council) for the purchase of the Airedale Gas Company's works, from which the ward of Idle is supplied. The terms are said to be mutually advantageous to the Corporation and the Company; but they are for the present secret. They have been arranged between the Town Clerk (Mr. F. Stevens) and the Company's Solicitor (Mr. F. Watson), and need, of course, the sanction of Parliament. The Airedale Gas Company was founded in 1853; and the capital consists of £21,000 of 10 per cent. stock, and £16,000 of 7 per cent. stock. In 1870, an Act was obtained empowering the Directors to raise further capital, and spend additional money on works. With the exception of a few years just after formation, the Company have paid maximum dividends. The price charged by the Company has been 3s. 9d. per 1000 cubic feet, less 5d. discount, as against 2s. 6d. per 1000 cubic feet in the city of Bradford, with varying discounts to large consumers.

ELECTRIC LIGHTING NOTES.

"L'Electricien" publishes, from a German source, some particulars in regard to the electric industry in Japan. It appears therefrom that there are 400 central supply stations, 19 of which furnish the current required for the working of tramways and light railways; while the rest are employed in the lighting of towns, and even of small localities, as well as for the distribution of energy for industrial purposes. In Tokyo, Kobe, Nagoya, Yokohama, and elsewhere, there are central stations producing current equal to 4000-horse power and upwards. The motive power required for the central generating station at Kioto is furnished by a turbine fed from a canal issuing from the Bitwa Lake. The waters of this lake, which flow into the sea in sufficient quantity to produce 25,000-horse power, are to be utilized for the production of current for lighting the town of Osaka.

In our "Notes" last week, reference was made to the appointment of a Receiver and Manager of the Hampstead Electric Supply Company, Limited. Our contemporary the "Financial News" claims that the proceedings in the Courts which led to this result completely justified the repeated warnings it gave the public in 1899 and last year not to buy the shares. The Company was registered on July 21, 1898, to take over the business of the London and Hampstead Battery Company, Limited. The capital is £200,000 in £5 shares—half being 5 per cent. preference and half ordinary shares. The last return on the file at Somerset House is dated May 21, 1900, though, it seems, it was not received and filed until June 11 of the present year. The position disclosed by the return shows that 17,826 of the preference and 11,270 of the ordinary shares have been issued. Of these, 9862 preference and 4903 ordinary shares were allotted as fully paid. There has been called up on 7964 preference and 6367 ordinary shares the full amount of £5. The total calls received come to £71,701, and the calls unpaid to £154.

A short time ago, the Corporation of Waterford authorized two electrical experts to draw up a report on the question of the establishment in the city of an undertaking for the supply of electricity. They have now presented it to the Electric Lighting Committee of the Corporation, and it will be considered by the Council at the next meeting. They strongly advocate the establishment of municipal electricity works for lighting and power purposes, and give estimates which demonstrate that, even with a small demand, it is commercially possible to carry on the works on a remunerative basis. They assert that the main streets can be lighted by electricity very much more efficiently than they are at present lighted by gas. A sum of £6000 is put down for the necessary buildings, &c. The estimated cost would be £29,774 capital outlay, and the revenue per annum would be £5995, while the annual working expenses would be £3290; leaving an annual average profit of £2705. This balance in receipts over cost could, in the first place, be made available for payment of the interest and sinking fund on the loan; and, secondly, for the reduction of the rates. The amount necessary for the payment of interest and sinking fund might be taken at 6 per cent. per annum, which, on a capital expenditure of £30,000, represents £1800 per annum for 25 years.

We learn from the "Builder" that the Stepney Borough Council propose to convene a conference of Metropolitan Councils to consider a recent decision of a Divisional Court upholding the finding of the Magistrate in the case of *Crow v. Whitechapel Board of Works*, in which the District Surveyor summoned the Board for having failed to give notice, in accordance with section 145 of the London Building Act, of their intention to construct inspection chambers and street-boxes for electric mains. It was contended on behalf of the plaintiff that the boxes were "buildings," "structures," or "works" within the meaning of the section; and the Magistrate, holding that an offence had been committed, inflicted a nominal fine with 10 guineas costs. The Divisional Court, which is the final Court for a matter of this kind, coming as it does under the Summary Jurisdiction Acts, dismissed the appeal with costs. In consequence of this decision, the Stepney Borough Council, which has absorbed the Whitechapel area, approached the London County Council with a request that facilities might be afforded for raising the point in a civil action, so that a decision of the Court of Appeal might be obtained, or that the District Surveyor should be asked not to insist upon strict compliance with the section upon which he founded his action. As the London Council are unable to grant either request, the Stepney Council have decided to hold the conference, and delegates from other Borough Councils are being asked to attend.

With the view of extending the use of gas, and in order to reduce the cost to the ratepayers of Hastings and St. Leonards of lighting the seafront, Mr. Chas. E. Botley, the Engineer of the Gas Company, recently made an offer to the Corporation to generate by gas power, and deliver to their leads in the vicinity of the gas-works, electric current of suitable frequency and tension for supplying the arc lamps on the Parade, and under agreement, at the rate or equivalent of 70 cubic feet of gas per Board of Trade unit—or equal to about 2⅛d. per unit. The front lamps apparently require something like 123,000 units of electricity per annum; and this quantity, at the price named, would cost £1291 10s. In the year 1899, the current for these lamps came to £2377; while last year a sum of £2443 was charged for it. Mr. Botley's offer thus showed a considerable saving to the Corporation, and therefore to the ratepayers, besides which there were the dues, &c., on the coal used to produce the gas. As this saving represented a rate of nearly ¾d. in the pound, one would have thought it would have commended itself to serious consideration. Unfortunately for the ratepayers, it was not entertained. We learn from a local paper that the offer was never submitted to the Corporation, but came before the Public Lighting and Electric Light Committee (which is composed of nineteen members, of whom seven are sufficient to form a quorum), with the result that a resolution was come to to "pass to the next business." "This," says our local contemporary, "is the answer returned by the Committee to a serious proposal."

There were two subterranean disturbances in London last week. One took place in Highbury Park on Tuesday evening; and it seems from the local reporter's story to have been a somewhat serious affair. Paving-stones, we are told, were torn up, broken, and hurled to a considerable height, the iron lids to five "shafts" were thrown into the roadway, a shop window was smashed to pieces, and the heavy iron railings of Christ Church, which stands at the top of Highbury Grove, were bent and damaged. The whole of the pavement in Highbury Park for a distance of about 50 yards was wrecked; but happily, with all this upheaval, no serious personal injury appears to have been sustained. On the point as to how the explosion was caused, the reporter throws little light. The Islington Borough Council have recently laid electric light mains under the pathway where the explosion occurred. After the explosion, the Borough Electrical Engineer was quickly summoned; but, so the pressman says, he at once satisfied himself that the mischief had not been occasioned by any defect in the electrical system, which was a very natural conclusion for an electrical engineer to arrive at. Then, with equal kindness and caution, and no doubt with a strong sense of justice weighing upon him, the reporter informs his readers that some employees of the Gaslight and Coke Company were working over the main; but it was not ascertained that the explosion was the effect of their work or of the artificial light they used. Continuing in the same wary strain, he adds that it is supposed that an escape of gas filled the "tightly plugged shafts;" but the actual cause had not been, at the time of writing, definitely ascertained. The second explosion occurred on Ludgate Hill on Wednesday night. Briefly, the facts are that some men were engaged in a "manhole" repairing a defective electric circuit, when, according to the newspapers, there was a loud rumbling noise, followed by a burst of flame, which rose "several feet" in the air. Two of the men were severely burnt; and two passers by who went to their aid were slightly injured by the flames. In this case the whole trouble appears to have been electrical, as, we believe, no escape of gas has been detected along the line of pipes.

THE SANITARY INSTITUTE AND WATER SUPPLY.

Programme of the Conference.

As already announced in the "JOURNAL," a conference on water supplies and river pollution, organized by the Sanitary Institute, will be held in St. Andrew's Hall, Newman Street, London, W., to-morrow and Thursday; meeting on each occasion at ten a.m. On the first of the days mentioned, the chair will be occupied by Sir A. R. Binnie, M.Inst.C.E., and the subjects for discussion will be introduced as follows: "Watershed Areas: The Physical Conditions and Standard of Purity to be Desired, and the Prevention of Contamination," by Mr. J. Parry, M.Inst.C.E. "The Protection of Underground Sources of Public Water Supply," by Dr. E. C. Seaton, F.R.C.P. "Rainfall and Population in Relation to Water Supply," by Dr. H. R. Mill, F.R.S.E. "The Desirability for Reports on the Water Supply of Each County," by Dr. A. Greenwood, D.P.H. "The Rivers of Glamorganshire, with Remarks on the Rivers of Adjacent Counties," by Dr. W. Williams, M.A., D.P.H. "Water Supply to Isolated Cottages and Small Groups of Cottages," by Dr. J. C. Thresh. "The Present Inadequate Water Supply for Villages and Village Schools," by Miss C. Cochrane. In the afternoon, the testing-shop of the New River Company at Clerkenwell will be visited, and the works of the East London Water Company at Lea Bridge. On Thursday, Mr. W. Whitaker, Assoc.M.Inst.C.E., F.R.S., will preside, and the subjects for discussion will be introduced as follows: "Water Supply and River Pollution," by Professor H. Robinson, M.Inst.C.E. "The Control of Weirs and Dams on Rivers in Relation to River Pollution," by Mr. A. G. Leigh. "Prevention of Pollution within the Thames Watershed, and Thames Water Supply and Storage," by Mr. H. W. Russell. "The Chemical Standard of Purity of Water Supplies," by Mr. H. R. Kenwood, M.B., D.P.H., F.I.C. "The Sterilization of Water," by Dr. S. Rideal, F.I.C. "The Commercial and Industrial Value of Soft Water," by Mr. Frederick Verney. The afternoon will be devoted to a visit to the Staines reservoirs; and in the evening the annual dinner of the Institute will be held at the Holborn Restaurant.

Mr. Percy Griffith, Assoc.M.Inst.C.E., of Westminster, has been engaged by the Hornsea Urban District Council to advise them on the subject of placing the water supply of the town in a thoroughly satisfactory condition.

THE BRISTOL CORPORATION AND THE WATER-WORKS.

Purchase Abandoned.

It may be in the recollection of our readers that the Bristol Corporation have for some few years had before them the question of purchasing the undertaking of the Bristol Water-Works Company; and the matter was placed in the hands of a Special Committee, with instructions to ascertain upon what terms the Company would be disposed to sell. After making formal inquiry, they reported to the Town Council, as far back as May 24, 1898, that the Directors were not prepared to enter into any negotiations for the sale of the undertaking to the Corporation. The Council thereupon resolved that the consideration of the report should be deferred until the Committee had reported on the following important points: (*a*) Whether any reductions in the charges now made by the Company for the supply of water can be enforced—the Committee being empowered to take Counsel's opinion hereon; (*b*) as to the charges for the supply of water now made by the Company compared with those in force in other large cities; and (*c*) generally as to the supply of water by the Company. The Committee gave the matter their careful consideration, and they answer the questions as follows: "(*a*) The Committee are advised that no reduction in the present charges of the Bristol Water-Works Company can be enforced; (*b*) a schedule of the charges in force in Bristol and in other large cities is annexed to this report; (*c*) there is at the present time a constant and sufficient supply of water. Your Committee do not, however, feel able to recommend the Council at the present time to apply to Parliament for powers to compulsorily acquire the Company's undertaking." The report of the Committee embodying their answers came before the Council last Tuesday.

Alderman H. DAVIES said he was afraid he was presenting a rather belated report. The causes of delay had been to some extent legitimate, and were, in a measure, due to the fact that not so much energy had been thrown into the matter as there should have been. The Committee were asked to report upon several questions. The first was whether any reductions in the present charges for water could be enforced; and upon this they were empowered to take Counsel's opinion. If there was one subject more than another that stirred up the Council to acquire the water-works, it was the feeling that the city was being charged more heavily for water, especially for workmen's dwellings, than other places, particularly where the supply was in the hands of the Corporation. The Committee had made inquiries, not only through their own legal officers, but also through such experts as were best qualified to give an opinion, and they were informed that, under the Acts which governed the Bristol Water Company, they were not able to compel the Company to reduce their rates, because at the present time they were not in some respects charging the full maximum amount to which they were entitled if they went to the extent of their legal rights. The Committee presented, with reference to the second inquiry, a schedule of the charges now being made by the Company, with a comparison of those current in other cities. In answer to the third question, the Committee stated that there was at the present time a constant and sufficient supply of water. He knew that, in the opinion of certain gentlemen who had not gone so thoroughly into the matter as some members of the Committee, the possession of the water-works would not only result in lower charges being made to the citizens, but would also enable them to tap a mine of wealth which would relieve the ratepayers. He thought they had better at once face the real facts, and disabuse their minds of any idea of that sort. It was right that the citizens should know that, as a source of revenue, there was nothing to look for by acquiring the water-works. He would go further, and say that, upon such advice as they had had from experts, the purchase of the works at such a price as the Company would be able to get, either by arbitration or otherwise, would throw a very heavy charge upon the ratepayers. Under the present circumstances, therefore, with the great undertaking to which they were already pledged in the docks, he did not think the Committee would have acted wisely in asking the Corporation to go into the very important question of purchasing an undertaking, the Directors of which were not prepared to state a price, and were not willing to sell. It was satisfactory to know, however, that there was an adequate supply of water, and there was no fear of the scarcity which had existed in some parts of the North of England. If he thought they could purchase the undertaking and make a moderate reduction to small householders, without seriously adding to the burdens of the city, he would be only too thankful to see the water-works acquired as a municipal undertaking. But as this could not be done, he did not think any useful purpose would be served by carrying the matter any farther. They had granted the Company many rights; and he was afraid that until an offer of their undertaking was made, there was very little prospect of the Corporation acquiring it.

Mr. ELKINS seconded the adoption of the report.

Mr. JONES said it had been stated that the purchase of the water-works would mean an outlay equal to 2d. in the pound on the rates; but he reminded the Council that in future the difficulties of buying the undertaking would become greater, as would also the necessity of purchasing it. Therefore he was prepared to go in for the purchase, because he believed that, while they looked largely at the expenditure side of the question, they did not consider sufficiently what they could gain by the transfer. He mentioned that Leicester paid £4,000,000 for the water-works, and had just made a profit of £7000. He was not desirous to make a big profit, but to ensure a full supply at a reasonable price to all who wanted it.

Mr. COLLINS: We have got that now.

Alderman DAVIES: But not at a reasonable price.

Mr. JONES thought that to pass the report in its present form would be a discredit to the Committee, who were appointed just seven years ago. He moved, as an amendment—"That this Council instruct the Town Clerk to take the necessary steps to promote a Bill in the ensuing session of Parliament for the compulsory acquisition of the Bristol Water Company's undertaking."

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 964.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME	Closing Prices.	Rise or Fall in Wk	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 11	10½	Alliance & Dublin 10 p.c.	19—20*	..	5 5 0
100,000	10	,,	7½	Do. 7 p.c.	12½—13½*	..	5 11 1
300,000	100	July 1	5	Australian 5 p.c. Deb. .	100—102	..	4 18 0
200,000	5	May 15	6½	Bombay, Ltd. . . .	6¼—6⅝	..	4 16 4
40,000	5	,,	6½	Do. New, £4 paid	4¼—4⅝	..	5 9 5
380,000	Stk.	Aug. 15	12	Brentford Consolidated	265—270	..	4 8 11
270,000	,,	,,	9	Do. New . . .	192—197	..	4 11 5
50,000	,,	,,	5	Do. 5 p.c. Pref. .	130—135	..	3 14 1
206,250	,,	June 14	4	Do. 4 p.c. Deb. .	113—116	..	3 9 0
220,000	Stk.	Sept. 12	10	Brighton & Hove Orig.	222—227	..	4 8 1
246,320	,,	,,	7	Do. A. Ord. Stk. .	155—160	..	4 7 6
1,047,500	Stk.	Aug. 28	5	Bristol, 5 p.c. max. .	118½-119½	..	4 3 8
420,000	20	Sept. 27	10	British.	41—42	..	4 15 3
50,000	10	Aug. 15	12	Bromley, Ord. 10 p.c. .	24—26	..	4 12 4
82,850	10	,,	9	Do. 7 p.c. . . .	19—21	..	4 5 8
500,000	10	Oct. 11	6	Buenos Ayres (New) Ltd.	8⅞—9¼*	..	6 9 9
220,000	Stk.	June 28	4	Do. 4 p.c. Deb.	96—98	+1½	4 1 8
150,000	20	July 17	8¼	Cagliari, Ltd. . . .	22—24	..	6 17 6
100,000	10	Sept. 27	10	Cape Town & Dis., Ltd.	14½—15½	..	6 9 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	53—55	..	5 9 1
550,000	Stk.	Oct. 11	12	Commercial Old Stock	270—275*	−1	4 7 3
236,425	,,	,,	9	Do. New do. .	203—208*	+½	4 6 7
238,237	,,	June 14	4½	Do. 4½ p.c. Deb.	130—135	..	3 6 8
800,000	Stk.	May 31	9	Continental Union, Ltd.	163—168	..	5 7 2
200,000	,,	,,	7	Do. 7 p.c. Pref.	162—167	..	4 3 10
575,000	Stk.	Aug. 29	5	Crystal Palace Ord. 5 p.c.	122—127	..	3 18 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	123—128	..	3 18 2
486,090	10	July 17	10½	European, Ltd. . . .	19—20	..	5 5 0
354,060	10	,,	10½	Do. £7 10s. paid	14—15	..	5 5 0
15,079,885	Stk.	Aug. 15	4 5/16	Gas-light and Coke { 4 p.c. Ord. . . 3½ p.c. max. . 4 p.c. Con. Pref. 3 p.c. Con. Deb.	97—99 / 88—90 / 111—114 / 91—93	−1	4 8 10 / 3 17 9 / 3 10 2 / 3 4 6
2,600,000	,,	,,	3½			..	
3,799,735	,,	,,	4			..	
4,063,425	,,	June 14	3			..	
70,000	10	May 31	8	Hongkong & China, Ltd.	13—14	..	5 14 4
3,800,000	Stk.	May 15	10	Imperial Continental .	213—216	..	4 12 7
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	100—102	..	3 8 8
561,030	Stk.	Aug. 29	10	Liverpool United A	229—232	−1½	4 6 2
718,100	,,	,,	7	Do. do. B	170—172	..	4 1 5
306,083	,,	June 28	4	Do. do. Deb. Stk.	119—120	..	3 6 8
75,000	5	June 14	4	Malta & Medn., Ltd. .	4½—5	..	4 0 0
560,000	100	Oct. 1	5	Met. of { 5 p.c. Deb.	104—107	..	4 13 6
250,000	100	,,	4½	Melbourne { 4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	May 31	3½	Monte Video, Ltd. . .	9—10	..	7 0 0
717,946	Stk.	Aug. 9	8½	Newc'tle & G'tesh'd Con.	224—226	..	3 15 3
312,855	Stk.	June 28	3½	Do. 3½ p.c. Deb.	97—99	..	3 10 8
150,000	5	May 15	8	Oriental, Ltd. . . .	7⅞—8¼	..	4 17 5
135,000	5	,,	8	Do. New, £4 10s. pd.	7—7½	..	4 16 0
15,000	5	,,	8	Do. do. 1879, £1 pd.	1⅞—2⅛	..	4 11 5
					*Ex. div.		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
60,000	5	Sept. 27	7	Ottoman, Ltd. . . .	5⅜—6⅛	..	5 12 0
851,070	10	Oct. 11	7	River Plate Ord. . .	10⅜—11*	..	6 7 3
250,000	Stk.	June 28	4	Do. 4 p.c. Deb..	96—98	..	4 1 8
250,000	10	Sept. 27	8	San Paulo, Ltd.. . .	11—12	..	6 13 4
135,000	Stk.	Sept. 12	10	Sheffield A	240—243	..	4 2 4
209,984	,,	,,	10	Do. B	240—243	..	4 2 4
523,498	,,	,,	10	Do. C	240—243	..	4 2 4
5,761,885	Stk.	Aug. 15	5	South Met., 4 p.c. Ord.	124—126	−1½	3 19 4
1,627,965	,,	July 17	3	Do. 3 p.c. Deb. . .	91—94	..	3 3 10
380,940	Stk.	May 15	5	Southampton Ord. . .	107—112	..	4 9 3
70,825	,,	July 17	4	Do. 4 p.c. Deb.	104—109	..	3 13 5
120,000	Stk.	Aug. 29	5½	Tottenham and Edmonton { A. 5 p.c. B. 3½ p.c.	120—125 / 90—95	..	4 8 0 / 4 4 3
250,520	,,	,,	4			..	
182,380	10	Jan. 16	5	Tuscan, Ltd.. . . .	8—9	..	5 11 1
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	95—100	..	5 0 0
230,000	5	Aug. 15	9	West Ham, 10 p.c. . .	9½—10½	..	4 5 9
172,000	10	,,	6	Do. 7 p.c. . .	12½—13½	..	4 8 11
140,900	Stk.	June 28	4	Do. 4 p.c. Deb.	107—112	..	3 11 5
				WATER COMPANIES.			
780,599	Stk.	June 28	11	Chelsea, Ord. . . .	310—315	+2	3 9 10
150,000	,,	,,	5	Do. 5 p.c. Pref. .	152—157	..	3 3 8
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	140—145	..	3 2 1
175,785	,,	Sept. 27	4½	Do. 4½ p.c. Deb. .	140—145	+2	3 2 1
1,720,560	Stk.	Oct. 11	7	East London, Ord.. .	200—205*	+½	3 8 4
654,740	,,	June 14	4½	Do. 4½ p.c. Deb. .	143—148	..	3 0 10
1,018,046	,,	,,	3	Do. 3 p.c. Deb. .	95—97	..	3 1 10
700,000	50	June 14	8	Grand Junction { 10 p.c. max.. 4 p.c. Deb..	112—115	..	3 9 7
310,000	Stk.	Sept. 27	4		122—126	..	3 3 6
708,000	Stk.	Aug. 15	14	Kent	290—295	..	4 14 11
160,000	,,	,,	7	Do. New, 7 p.c. max..	200—205	..	3 8 4
1,043,800	100	June 28	10½	Lambeth, 10 p.c. max..	297—302	..	3 9 6
406,200	100	,,	8	Do. 7½ p.c. max..	215—220	..	3 12 9
350,000	Stk.	Sept. 27	4	Do. 4 p.c. Deb..	125—130	..	3 1 7
500,000	100	Aug. 15	12 5/10	New River, New Shares	395—405	..	3 3 2
1,000,000	Stk.	July 31	4	Do. 4 p.c. Deb..	125—130	..	3 1 7
902,300	Stk.	June 14	6	South-wark and Vauxhall { Ord. . . . 7½ p.c. max. 5 p.c. Pref. . 4 p.c. A Deb.	197—202 / 182—187 / 147—152 / 124—129*	+4 / +4 / .. / +1	2 19 5 / 3 4 2 / 3 5 9 / 3 2 0
126,500	100	,,	6				
489,200	Stk.	,,	5				
1,019,585	,,	Oct. 11	4				
1,155,066	Stk.	June 14	10	West Middlesex. . .	290—300	..	3 6 8
200,000	,,	,,	4½	Do. 4½ p.c. Deb. .	138—143	..	3 2 11
200,000	,,	Sept 12	3	Do. 3 p.c. Deb. .	94—97	..	3 1 10
					*Ex. div.		

Mr. BASTER seconded the amendment.

Mr. POPE remarked that they were not so well off in Bristol as they might be. In one of the papers that morning, they were told that the income of the Water Company was (he supposed it was only hypothetical) about £127,000. He believed that, if the figures were carefully gone into, they would find this was sufficient to pay 3½ per cent. on the purchase price.

Mr. Jones's amendment was rejected without a division.

Mr. HARRIS thereupon moved, as a further amendment, that it be an instruction to the Committee to approach the Company, with a view to securing a reduction of the water charges in the districts of Stapleton, Horfield, and Brislington.

Mr. SAISE seconded the proposition.

Alderman DAVIES thought the resolution should be addressed to the Council rather than to the Water-Works Purchase Committee. Until the Water Company went to Parliament for fresh powers, the Corporation could not compel them to make any alteration in their charges.

Mr. HARRIS said his idea was that they might find a spirit of "sweet reasonableness" displayed by the Directors of the Company.

Alderman PROCTOR-BAKER suggested that the resolution should be referred to the Health Committee.

This was agreed to; and the amendment was carried by 31 votes to 27. The report was afterwards adopted; and the Committee's protracted labours were brought to a close.

BRADFORD WATER SUPPLY.

Proposed New Reservoir.

At the Meeting of the Bradford City Council last Tuesday, an important proposal for an extension of the water-works was under consideration. The Water Engineer (Mr. James Watson, M.Inst.C.E.) had reported to his Committee that the present state of the water supply and works calls for early and serious consideration as regards existing scarcity and future wants. The consumption, which is constantly increasing, largely exceeds the supply that can be obtained from the old gathering-grounds in years of average rainfall; and intermittent or short service has had to be resorted to year after year. In the near future, the present supply will be supplemented by water taken directly from the River Nidd; but that can only be utilized to a comparatively small extent until provision is made for storing it. Mr. Watson, taking the normal consumption of water per day in the city and out-townships at 14 million gallons, estimates that storage to the extent of 2520 million gallons is needed. The aggregate capacity of all the present reservoirs, impounding and service, is only 1760 million gallons—a deficiency of 760 million gallons. The Nidd Valley scheme provides for the construction of three large storage reservoirs on the River Nidd, at High Woodale, Lodge, and Angram, with a total storage capacity of 2596 million gallons; and Mr. Watson recommends that the first of these—the Angram reservoir—should be proceeded with as quickly as possible. This would add 810 million gallons to the existing storage. The Angram reservoir and the works connected with it will take seven or eight years to construct, by which time Bradford will be using to the full the direct supply from the Nidd, and be ready to utilize the further increased supply which the new reservoir will afford. Mr. Watson proposes to alter the site of the main embankment from that shown on the parliamentary plans, and by so doing to get 200 million gallons greater storage capacity. Alderman Holdsworth, the Chairman of the Water Committee, remarked that the construction of the reservoir at Angram was most important. Notwithstanding the fact that a very large amount had been spent to bring the Nidd water into Bradford, yet, taking into consideration the great increase in the consumption of water in the city, it really was necessary that there should be a storage reservoir of large capacity to take the water from the Nidd Valley. This would in itself become a stand-by to the works. The daily consumption in Bradford had risen from 12½ to 15½ million gallons during the past six months, and the actual present supply was rather less than 12 million gallons. The Nidd Valley water gave a flow during the dry season of only between 4 and 5 million gallons per day; but with proper reservoirs it could be brought up to 20 million gallons. The construction of the new reservoir would involve the provision of a concrete embankment; but by altering the position of this, Mr. Watson calculated upon getting a reservoir with a capacity 200 million gallons greater than had originally been designed, and with an embankment of 120 feet, they would have a capacity of 810 million gallons. Altogether, the expense of the reservoir would be £300,000—very little more than was the cost, considering the storage capacity, of the two previous reservoirs constructed by the Corporation. He anticipated further progress in the trade of the city, and believed the present generation of the Council would not live to see the day when no new works were required for the supply of water to Bradford. Alderman Ratcliffe, as Chairman of the Finance Committee, pointed out that the suspension of the sinking fund in connection with the present water-works would expire in June, 1904; and he asked if it was anticipated that by that time the increased revenue from the sale of water would overtake the repayment of capital—in other words, if the income would exceed the expenditure. Alderman Holdsworth said that if the consumption went on increasing as it had done, provided the present charges were not lowered, he thought that would be the result. The proposal was sanctioned.

EXETER WATER SUPPLY.

A Visit of Inspection to the Works at Pynes.

On Tuesday last, a reception was given by the Chairman (Mr. H. A. Willey) and the Vice-Chairman (Mr. A. M. H. Walrond) of the Exeter Chamber of Commerce, in connection with which there was an inspection of the water-works extensions at Pynes, which are now well on the way to completion. The party were under the guidance of the City

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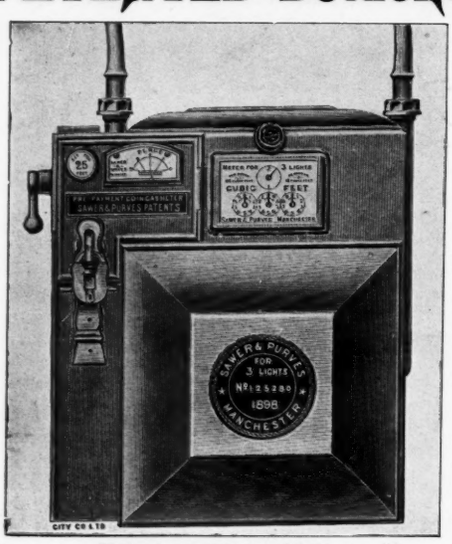
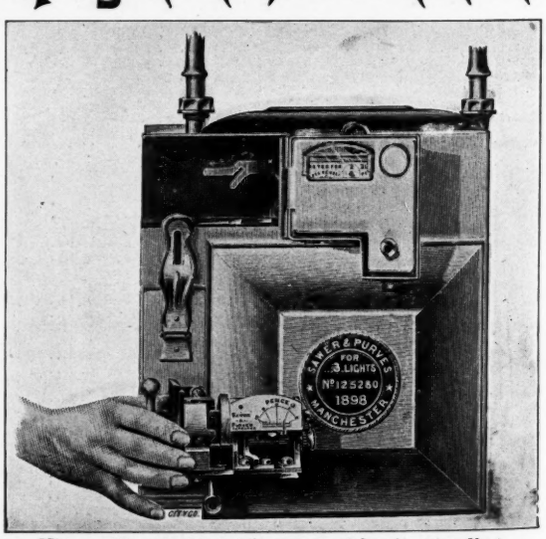


Meter in working position.



Meter with attachment removed without uncoupling.

Surveyor (Mr. D. Cameron), who gave some interesting information in regard to the existing water supply and the works now in hand. He stated that the old works for the water supply of Exeter consisted of a brick culvert, 1¾ miles in length and 2 feet in diameter, laid from the intake at Stoke Canon to Pynes pumping-station, from whence the water was pumped to two reservoirs at Dane's Castle, having a head of 156 feet above the pumping-station. The water at Dane's Castle was filtered, and then forced through a 7-inch rising main to a reservoir at Marypole Head, at a height of 270 feet above the filter-beds. The reservoirs at Dane's Castle supplied the low-level consumers, numbering fully two-thirds of the population; the remainder, forming the high-level portion, being supplied from Marypole Head. In the years 1897 and 1898, the Water Committee had under consideration the question of a better supply and more storage capacity; and in April of the latter year, application was made to the Local Government Board for leave to borrow £36,000 for new works. The necessary consent was given; and the works were started in August, 1899. The works now nearing completion consist of a new conduit 1½ miles in length by 2 ft. 6in. diameter, from the intake near Stoke Canon to the settling reservoirs at Pynes. The two settling reservoirs are each 224 ft. by 164 ft., with 11 ft. 3 in. depth of water; the holding capacity being thus about 2 million gallons each. There are six filters, each 210 ft. by 57 ft. by 6 ft. 6 in. deep, with 3 feet of filtering material (Fremington sand), and a filtering area of 72,000 superficial feet each, capable altogether of filtering 3 million gallons per day. The water from the settling reservoirs will gravitate to the filter through an 18-inch main, and after being filtered will flow to the pump suction wells, from which it will be pumped through a 14-inch rising main, by means of turbines and steam-engines, to a new intermediate reservoir at Pennsylvania and the existing reservoir at Marypole Head, or else through the old 12-inch rising main and a new 18-inch rising main to the old filter-beds (now to be employed as reservoirs) and the existing reservoirs at Dane's Castle. The new pumping plant will consist of a Worthington engine capable of lifting 2½ million gallons per day, a Cornish boiler, and three new vortex turbines. The whole of the pumping capacity will amount to over 3 million gallons per day. The turbine-house has been enlarged, and a new engine-house erected for the Worthington engine. The banks of the leat from Pynes to the leat intake will be raised 2 feet, and the sides made with concrete blocks, so as to give a better head for the hydraulic machinery. The intermediate reservoir at Pennsylvania is 83 ft. by 54 ft. by 19 ft. deep, with a capacity of 500,000 gallons. The whole of the pumping plant will be taken away from Dane's Castle, and, if suitable, used at Pynes. The existing storage capacity is about 5,384,000 gallons, which will be increased by the new works to 10,000,000 gallons. At present the unfiltered water is conveyed from the intake at Stoke Canon to Pynes pumping-station, and there pumped through 10-inch and 12-inch rising mains to the Dane's Castle receiving reservoirs, passing from the reservoirs to the filter-beds, and from the filters into a clear-water well, from which it is again pumped up to the reservoir at Marypole Head. Under the present system, through having the pumping-stations, filter-beds, and reservoir at different places, it is necessary to work two sets of pumping plant, entailing double cost. Under the new system this will be remedied. The intake, settling reservoirs, filters, and pumping plant will be all at one station. On the return of the party from the inspection, Mr. Willey proposed a vote of thanks to the Chairman of the Water Committee, the City Surveyor, and other officers, for their kindness in enabling the Chamber of Commerce to view the works in progress; remarking that he inherited an interest in the Exeter water supply, as his late father was one of the Committee mainly responsible, many years since, for the acquisition of the undertaking by the Corporation. Some time ago, he took the trouble to have the water analyzed, and was gratified to find, on the evidence of the most eminent Analytical Chemist, that it was second to none. The estimated cost of the new works, when completed, is £48,000.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In the Aberdeen Town Council on Monday, the recommendation of the Gas and Electricity Committee that powers be obtained for the borrowing of £200,000 on mortgage, to provide for extensions upon the gas and electricity undertakings, came up for consideration. Bailie Taylor asked why so large a sum was required; and in reply Mr. Kemp, the Convener, said that the matter came up through a report by the Gas Manager, in which it was pointed out that the demand for gas was growing by leaps and bounds, and that provision would require to be made within the next few years for a large extension of the works. The Manager (Mr. A. Smith) reported that the increase in the output of gas during the past year, as compared with the previous year, was 50 million cubic feet; and in the year before there was an increase of 30 million cubic feet. The extensions must be begun at no distant date, and would cost about £35,000 for retorts, connections, and sidings; £12,000 for condensers, purifiers, and connections; £10,000 for main pipes; and £50,000 for consumers' meters —a total of £107,000. Then there was the amount at the debit of the capital account, £20,570, less borrowing powers in existence to the amount of £11,700, making a total required of £115,870, or, in round numbers, £120,000. In connection with the Electricity Department, he did not think they were overstating the matter when they estimated their necessary expenditure during the next ten years at £80,000, which made up the £200,000 mentioned in the minute. They would understand that the money would not be spent without the sanction and control of the Town Council at the time. The Council gave power to the Committee to make application for the borrowing powers in the first Bill which the Corporation present to Parliament.

The shareholders of the Newport Gaslight Company, whose undertaking has been acquired by the Corporation, held their 45th, and final, meeting on Saturday last. It was reported that the quantity of gas

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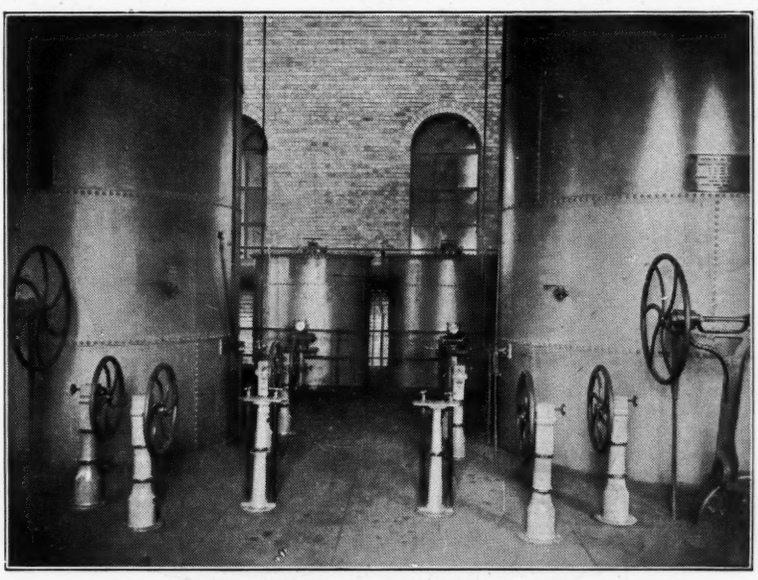

RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One-Fifth Section of Birmingham Plant, Windsor Street Station.
The Maximum Daily Capacity of the Birmingham Corporation's Plant, which was erected by this Company, is 12 MILLION CUBIC FEET.

consumed during the year was 9,813,934 cubic feet, or an increase of 183,298 cubic feet; and that the gross revenue (£2843) was £294 higher than in the previous year, and was the highest they had ever had. The Directors recommended that a dividend at the rate of 5 per cent. be paid, and that a balance of £371 be carried forward to the closing account of the Company, subject to the remuneration of the Directors. They did not think it would be safe to divide the whole funds for a few months, so as to ensure that all claims against the Company might be met; but they recommended that £1 10s. per share be distributed at present, and the balance three months hence. The report was adopted, as were also two resolutions to the effect that the sale to the Corporation be confirmed and that the Company be dissolved. Sir John Leng, who is a shareholder, said that he had always regarded the Company as a well-managed one; and he advised the proprietors to treat the officials generously, and to suitably recognize the labours of the Directors, who had not taken a penny since the starting of the concern. In every company he had been connected with, he had advocated the payment of moderate dividends. If they did not get the return in immediate dividends, they obtained it in the increased value of their shares. They had a good exemplification of this in the present case. The shareholders had not taken anything like the dividends they might have insisted on. Instead of doing so, they had met a growing demand for gas, added to the productive power of the works, and (as had been proved) to the value of the plant and of the undertaking as a going concern. They were now having, as it were, the arrears of dividend paid up by a bonus on the nominal value of the shares. They would have a handsome bonus of something like 12s. per share, with which he, for one, would be quite content.

A meeting of the local branch of the Gas Workers' and General Labourers' Union was held in Aberdeen on the evening of last Saturday. A quarterly report which was submitted showed that the branch had five times as many members as it had when it joined the Union a year ago. Well, the number might have been given. As it has not, one may conclude that it is not very large. It is apparent that the Union are not to encourage any action being taken by the men in opposition to the Corporation, on account of their refusal to grant the men's requests. The last that was heard upon the subject was that the men were to wait for instructions from the Central Committee. These, it would appear, have not been received.

In connection with gas affairs at Greenock, an important speech has just been made by Mr. Bailey, who is a comparatively new member of the Town Council. He is, however, upon the Corporation Gas Committee, and hence may be said to speak with authority. His address was devoted almost exclusively to gas affairs. In times past, he said, magnificent results had been obtained and large profits realized; and while they admitted that there had been certain difficulties through the exceptional price of coal, and the appointment of a new Manager and a new Committee and Convener, things must be put on a more satisfactory basis than they were at present if the concern was to be a success. The point which they had to deal with was that they had spent £8000 or £10,000 for machinery which was not being used. If the system at Inchgreen was not suitable, let them do away with it, and not have on the capital account £8000 or £10,000 of apparent assets, which, in the opinion of some of the members, were not worth the paper that they were written upon. At present, they had three systems at work; but he held, as a business man, that there should only be one, and that the very best by which gas could be made. The state of the Gas Department was a serious matter for the town, because investors were already anxious about the whole concern; and while he was not saying who was to blame, he was sure he was correct in stating that there was no reason whatever why the Gas Trust should not be the best and most profitable thing they had in Greenock. One of the few suggestions which he had made in the Council was that they should take trial balances perhaps during three or four months, and then they would be able to see how they were going on. The question of obtaining better light had been debated over and over again; and the Manager had been impressed with the absolute importance of giving a regular and uniform supply of gas. On the last occasion when the subject was considered, he was instructed to prepare a report as to what remedies he proposed in order to ensure what was necessary. So far as they could gather, it meant an increase of expenditure, as they were given to understand that a number of alterations would be required. The Manager might be right; but he could not see that it was the duty of the representatives of the Sixth Ward to let the matter rest. They ought rather to find out if an improvement meant more cost, and, if it did, to come boldly before the ratepayers and tell them so.

The great scarcity of water which has been felt in Edinburgh for the past few weeks still continues. At a meeting of the Edinburgh and District Water Trustees on Thursday, ex-Bailie Archibald (Leith) made a statement with regard to the supply. He said that by the last returns they had lost during the fortnight about 112 million gallons. There were occasional showers; but they had not as yet made much impression. At the same time, he had to hold out a little encouragement. In the previous week, the loss was less than the week before. For three days the Gladhouse reservoir, which was giving out 8 million gallons a day, fully held its own. That was to say, this quantity of water had come in. At the same time, he did not think they would be able to supply more water for the next three months. They were giving 14½ million gallons per day in Edinburgh, Leith, Portobello, and the adjacent villages; and after allowing a liberal quantity for trade and shipping—at the rate of 14 gallons per head per day—this left about 20 gallons per head. He had no doubt the present scarcity might be a blessing in warning people against the waste of such a precious liquid as water, because there had, no doubt, been a lot of waste. They would get no addition to the supply until the Talla works were completed; and at the very soonest that might be four or five years yet. It is reported to-day that the Gladhouse reservoir has gone down 1 inch since Wednesday, and is now 12½ feet below its normal level. There has been some rain to-day, but not much.

Mr. John Anderson, addressing his ward constituents at Greenock recently, dwelt largely on the work of the Water Trust, which, he said, was one of their most important municipal departments. The last

[No. 3 SPECIMEN DAY CONSUMPTION DEVELOPER ADVT.—ELECTRO LENT ON APPLICATION to THE RICHMOND GAS STOVE AND METER COMPANY, LIMITED.]

Provisional Order had brought the Trust completely under the control of the Corporation. Formerly it consisted of thirteen gentlemen, who elected their own chairman, officials, &c., and administered the different Acts of Parliament bearing upon the supply of water in connection with the community. Now the Corporation would appoint a Committee who would have to report to them. This change was on correct lines, and was quite in harmony with popular representation. He then traced the history of the Trust from the formation of the Shaws Water Company in 1825 to the time when it was handed over to the Corporation in 1866. The promoters of this great water scheme, he said, were public-spirited gentlemen, whose outlook was indeed broad; and the community of Greenock should entertain towards them heartfelt gratitude. The price paid for the works was £170,000; while the value in the books now was £435,000. The capacity of the works when the Company handed them over was rather more than 300 million cubic feet of space. Their remarkable storage capacity to-day was almost exactly double that. But not only were the works larger now than they were in 1866, but the price for water was greatly reduced, as in the year named it was 1s., while since 1893 it had only been 6d. in the pound. Mr. Anderson subsequently urged the desirability of extending the storage capacity of the works, and the propriety of making an effort to bring in new industries to use up the water or, at all events, the surplus thereof.

The following somewhat peppery letter appeared in the "Glasgow Herald" on Wednesday: "So many lectures have lately been given on the scientific use of nitrates in manuring, that I feel a word of practical warning may be of some use to farmers and the unscientific public. What is the practical result of the use of nitrates in the growth of hay, for instance, in Ayrshire? It has been to send nearly all the best customers to Canada for their hay supply. I have owned horses in Ayrshire for the last 30 years, and till last season have succeeded, by paying top price for my hay, in receiving it all grown with farm manure only. This year a serious case of diabetes occurred in my stables—the first I have ever had. On inquiries being instituted, it was found that the hay had been heavily manured with nitrates, although I had been assured it was not. I hate leaving home for foreign markets; but after such a lesson, I was forced to follow the example of, I fancy, ten out of every twelve stables in Ayrshire, and import my hay from Canada. It is 35 years since one of the best stud-grooms in the country told me if ever I had hay grown with nitrates, I would never be without a case of diabetes among my horses. This statement has been proved correct, unfortunately. The exhaustion of land by the use of nitrates is, I believe, sometimes disputed. A practical anecdote will, I think, throw some light on the subject. Speaking lately to a farmer who owns a farm in one county, and rents one in another, I asked him if he used nitrates. He said: 'Nitrates; oh, yes, I use plenty in ——; they force a grand crop, and I must make all I can. But I never use any in ——. You see, the land is my own.'" The letter is signed "Anti-Nitrate." The statements in it are somewhat startling; but they have an air of reasonableness about them. This "embargo" on the use of nitrate of soda should please sulphate producers.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 12.

Sulphate of Ammonia.—There has been a good demand; but supplies have been rather more abundant, and prices have been barely maintained. The closing quotations are £10 11s. 3d. per ton f.o.b. Hull, £10 15s. per ton f.o.b. Leith, and £10 17s. 6d. to £10 18s. 9d. per ton f.o.b. Liverpool. There has also been business for October delivery on the level of spot prices; but a premium is generally asked for November and December. There are sellers at £11 2s. 6d. per ton f.o.b. Leith over spring months; but this is really above buyers' ideas of value.

Nitrate of Soda is steady at 9s. 3d. to 9s. 4½d. per cwt. on spot.

LONDON, *Oct.* 12.

Tar Products.—Pitch continues in very strong demand for South Wales; and business is being done for January-June at fairly good prices, although not equal to those which are being paid for prompt. Tar distillers have practically no stocks; but, of course, the make will soon be increased, which will relieve the present pressure. As regards London, manufacturers are not offering anything for this year. Business is reported in Beckton at 32s. for January-March. As regards 90 per cent. benzol, one or two sales have been made for prompt delivery at 9½d. London; but at some of the outports, a little less than this has been accepted for prompt shipment, although for November-December 10d. is the ruling quotation. In 50-90 per cent., there is an absence of business for export. Some quantity has been placed for home consumption at 9½d., delivered to consumers' works. In anthracene there is nothing doing for prompt; but there are some inquiries for July-December next. Consumers, however, are only prepared to consider business in "A" quality of high percentage at low prices. Great depression prevails in toluol. There are sellers at 10d.; but even at this it does not find buyers. Sales of 60's crude carbolic are reported at 1s. 11d. But the market appears to have subsided; and it is generally believed that manufacturers will have no difficulty in making their October deliveries. Crystals are very quiet indeed. Business is reported in 39-40's at 7d., and in 34-35's at 6½d. per pound. Some contracts have, however, been passed in picric acid which may tend to improve this article later on. Creosote is still quiet in the North; and some contracts have been let at very low prices. London, however, continues very firm, and prices are well maintained. Should the present depression continue in the North, some of the largest manufacturers will use the oil as liquid fuel. In fact, it is believed that several of them have already made arrangements to burn a considerable portion of their make during the coming winter. Besides this, the present price is so low in the North that it will soon pay to send it to London, if a low rate of carriage could be obtained. With regard to tar, prices continue quiet; but no important contract has recently been let. Distillers are very chary of paying high prices forward; for, should a drop take place in pitch early next year, they would find themselves

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saddled with a considerable loss, as all the other products are in a depressed state.

The average values obtaining during the week are: Tar, 14s. 6d. to 17s. 6d. Pitch, east coast, 30s. 6d. to 31s. 6d.; London, 32s.; west coast, 29s. 3d. to 29s. 9d. Benzol, 90's, 9½d.; 50's, 9¾d. Toluol, 10d. Crude naphtha, 4¼d. Solvent naphtha, 10d. to 11⅛d. Heavy naphtha, 10d. to 11d. Creosote, London, 1⅝d.; North, ⅜d. Heavy oils, 2d. Carbolic acid, 60's, 1s. 10½d. to 1s. 11d. Naphthalene, 60s. to 70s.; salts, 35s. to 45s. Anthracene, "A," 40-45 per cent., 2¼d. to 2½d.; "B," unsaleable.

Sulphate of Ammonia.—The market is decidedly quiet. The Gaslight and Coke Company still quote £10 15s. for October-December, but another large company have accepted £10 11s. 3d. for October shipment, while there are sellers at £10 10s. Beckton terms, prompt shipment. In Hull, further business has been done at £10 12s. 6d. prompt; and £10 15s. is being offered for November-December. In Leith, business is reported at £10 15s. for October delivery. There is evidently a special demand from this port. There is no change as regards Liverpool, and no business of importance to report.

COAL TRADE REPORTS.

Lancashire Coal Trade.—A generally firm tone is maintained in Lancashire, as regards all descriptions of round coal, which, though the demand is not actually pressing, and perhaps not taking away all that the collieries are raising on full time, is moving away steadily, at the list rates of last month, with a continued tendency to harden in the lower qualities, where prices have previously been cut low. House-fire descriptions are in fairly good demand, considering the exceptional mildness of the season; and common round coals are in moderate request for steam and forge purposes, with the shipping business well maintained, and larger quantities going away for gas-making requirements. At the pit, the better qualities of Lancashire house coal are firm at 15s. per ton, seconds at 13s. to 13s. 6d., common at 11s. to 11s. 6d., and steam and forge coal at 9s. For shipment, good qualities of steam coal are quoted 10s. 3d. to 10s. 6d. per ton delivered at the Mersey ports. The engine fuel trade remains in a very unsatisfactory position. Supplies are offering on the market largely in excess of requirements, especially in the lower sorts. Although in the Lancashire district prices are fairly steady at late rates, there is an increasing keenness of competition from other districts, which is steadily cutting into the business of local collieries, and compelling them to ease down in their prices rather than allow the business of their regular customers to be taken out of their hands. At the pit, common Lancashire slacks average about 5s. 6d. to 6s. per ton, and the better qualities 7s. to 7s. 6d.; but good sorts of slack can be bought from both Derbyshire and Staffordshire at considerably under these figures. Derbyshire slack, equal to the better qualities of Lancashire slack, has been sold recently to merchants at about 3s. 6d. per ton at the pit; and this is being pushed on customers in the neighbourhood, to the detriment of local collieries.

Northern Coal Trade.—The coal trade is active as far as Durham kinds are concerned; but steam qualities are weaker. Best Northumbrian steam coals are dull in sale. The demand for the upper ports of the Baltic is now nearly ended for the season; and this has naturally had an effect on the price, which is from about 11s. 6d. to 12s. per ton f.o.b., though few collieries are able to obtain the latter price. Steam smalls are steady at from 5s. to 5s. 6d. per ton. In the gas coal trade, there is a steady demand, fully up to the production; and best Durham gas qualities are brisk in inquiry, and rather scarce, so that 12s. 6d. per ton is asked for occasional cargoes, and even 12s. 9d. per ton f.o.b. is spoken of as possible. These high prices naturally influence the quotations for gas coals for forward contracts; but only limited inquiries come forward for these. Coke is steady, and best Durham is firmer at 17s. 6d. to 18s. 6d. per ton f.o.b. Blast-furnace coke sells at 16s. 6d. per ton at the Teesside furnaces. Gas coke is plentiful, and the production is increasing; but there seems a fair general demand, and the exports are about an average. The quotation f.o.b. in the Tyne for gas coke is from 12s. 6d. to 13s. per ton; but it will stiffen should the better prices for other classes continue.

Scotch Coal Trade.—Trade remains unchanged. There is a good demand; but the supply is equal to it, and prices keep steady. These are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 6d. to 11s. 6d., and splint 10s. 9d. to 11s. The shipments for the week amounted to 217,066 tons—an increase of 8649 tons upon the previous week, but a decrease of 4164 tons upon the corresponding week of last year. For the year to date, the total shipments have been 7,547,844 tons—a decrease of 910,714 tons upon the same period of last year

The Directors of the Imperial Continental Gas Association recommend a dividend of 5 per cent. for the six months ending the 30th of June, tax free.

Referring to the recent meeting of the Eastern Counties Association, the "Cambridge Chronicle" mentions the fact of Mr. R. Brown, the Manager of the Cambridge Gas Company, being the President, and then goes on to say: "In an admirable Inaugural Address, the President pointed out that gas companies had little to fear from the competition of electric lighting companies, so long as they kept pace with the latest and best machinery for the manufacture of gas. The truth of this is seen in Cambridge. Energy and enterprise have marked the recent policy of the Directors of the Gas Company, with highly satisfactory results. The public are now supplied with an illuminant of a high standard, at a much lower cost than the Electric Company can hope to supply lighting power at; and there is promise of a further reduction in price. Ratepayers will always look at this question from the monetary point of view; and a large majority of them may be depended upon to use gas in preference to electric light, provided its purity is beyond question, and the cost reasonable."

CLARK'S PATENT "SYPHON" STOVES.

Copy of Letter recently received referring to No. 22 Syphonettes.

. . . "They give out a splendid heat at comparatively small cost for gas. The temperature of the room can be now regulated to a nicety, which is a great advantage in a public hall. If desired, the heat can be shut off instantly, whenever the temperature suddenly rises, as it almost invariably does when dancing has commenced.

We have been commended over and over again for introducing them here; and they are really a grand invention."

NEW POWERFUL HEATER.

No. 22 "SYPHONETTE."

Consumers appreciate an Economical Heating-Stove.

WRITE FOR NEW SEASON'S CATALOGUE.

S. CLARK & CO., PATENTEES AND MAKERS, "SYPHON" WORKS, **PARK ST., ISLINGTON, LONDON, N.**

Cirencester Gas Company.—At the recent annual meeting of this Company, the accounts presented showed that in the year ending June 30 last the sale of 35,139,100 cubic feet of gas produced a revenue of £7401; while the total receipts were £9499. The expenditure being £6991, the balance carried to the profit and loss account was £2508. This was about £30 in excess of that realized in the year 1899-1900, though £950 more was spent on coal. After payment of the interest on debentures, &c., and the interim dividend, the sum available for distribution was £1321; and the Directors recommended the declaration of the statutory dividends of 10, 7, and 5 per cent. The demand for cooking-stoves and prepayment meters has continued —an additional 100 having been supplied during the year.

Reservists' Fund at the Windsor Street Gas-Works.—At a general meeting of the employees, held on Monday last week at the Windsor Street Gas-Works, Birmingham—Mr. Charles Hunt in the chair—it was reported that the dependants of sixteen Reservists who had been called from the works had participated in the benefits of the fund. The Workmen's Committee expressed their pleasure in announcing that not a single death of their fellow-workmen had been recorded; and though several had been invalided home, either sick or wounded, 15 of their number had actually returned to work. Since the starting of the fund, a total sum of £262 7s. 8d. had been collected, of which £210 had been expended in giving relief to the dependants of the Reservists who had been called from the works. It was resolved to close the fund, and to present to each of the Reservists a silver pocket tobacco-box, bearing a suitable inscription, as a memento of his services in his country's cause.

Breaking Up Roads in London.—At the meeting of the London County Council last Tuesday (the first after the summer vacation), Mr. John Burns, M.P., asked the Chairman of the Highways Committee (Mr. J. Williams Benn) whether the Committee would take immediate steps to prevent the frequent breaking up of roads and streets in the centre of London, either by central authorization, or in such a manner as would enable all the companies to do together what they now seemed to prefer to do one after the other, to the general inconvenience of everybody and cost to themselves. Mr. J. Piggott suggested that application should also be made to the City authorities, in order that they might act in unity. Mr. Benn said the Council had no power to interfere with regard to the breaking up of the streets of London. They had a sort of visionary power under the Local Government Act of 1888, but it disappeared for all it was worth in connection with the Act which established Borough Councils in the Metropolis. If the action of the Council were rightly understood, it might be possible to approach the road authorities of London, so that the central authorities might exercise some power by way of supervising the action of the companies. The matter had become so serious that, if the Council thought it advisable, the Highways Committee would be glad to approach the Local Authorities, to see what could be done in the way of combined action for the protection of London. They would certainly communicate with the City, in order that they might secure the assistance of the Corporation.

A Financial Critic of the Gaslight and Coke Company.—The accounts sent out by the Gaslight and Coke Company for the past quarter's consumption bear upon them a slip announcing that after the 1st of January next the price of gas will be reduced from 3s. 5d. to 3s. per 1000 cubic feet. The "Financial News," alluding to the reduction, says: "This is a welcome evidence of the fall in the cost of coal; but London consumers are still anxious to know when that part of the price of gas that is due to incompetency is likely to come off."

Incandescent Gas Lighting at Sheffield.—The Chief Constable of Sheffield (Commander Scott) has presented to the Watch Committee of the Corporation a report on the subject of the incandescent gas lighting in the public thoroughfares of the borough, of which the Committee took charge on the 1st of July last year, on the understanding that they were to continue to pay the same price for gas as hitherto. Attached to the report is a return showing that the total number of lamps in the city is 7994, of which 1376 have now incandescent burners, and 6618 flat-flame burners. Since the Committee assumed responsibility for the lighting, 823 lamps have been converted from the flat-flame to the incandescent type. The return also shows that the quantity of gas consumed per hour in a flat-flame (single-burner) lamp is 5½ cubic feet, while an incandescent lamp (one burner) consumes 4 cubic feet per hour. The cost per lamp per annum is respectively £1 17s. 7d. and £1 7s. 4d.—showing a difference of 10s. 3d. a year in favour of the incandescent pattern. In the case of a two-burner lamp, the difference in cost per annum is worked out to £1 3s. 4d.; and in the case of a three-burner lamp, to £2 13s. 4d. The cost of altering a single-flame lamp to an incandescent lamp is 8s. 11d., and allowing 2s. 6d. per lamp for renewals, the Chief Constable estimates the annual saving per lamp to be 7s. 9d.

Rhos in Darkness.—A largely attended meeting of ratepayers was held on Thursday evening at the Rhos Public Hall—Alderman E. Hooson, Chairman of the Parish Council, presiding—to consider the lighting of the town lamps. Efforts were made some two months ago to get a reduction in the price of gas, which stood at 4s. 7d. per 1000 cubic feet, with the result that the Gas Company reduced it to 4s. 2d. The Council considered this too high, and resolved not to light the lamps until the figure was reduced to 4s. A deputation interviewed the Secretary of the Company on the matter, and the latter wrote to the Council stating that no further reduction could be made. The Council thereupon decided to convene a meeting and lay the matter before the ratepayers. The Clerk (Mr. J. Trevor Jones) read the correspondence which had passed between the Council and the Company on the matter, and Mr. W. M. Jones gave a report of the interview which the deputation had with the Secretary. Mr. W. Green then proposed that they should accept the terms offered—*i.e.*, 4s. 2d. per 1000 feet—until April next. Mr. Daniel Davies seconded the motion, with the addition that the Parish Council should endeavour to find some company to bring the electric light into the district. Considerable discussion took place, and Mr. R. Jones moved, as an amendment, that they should decline to accept the Company's terms. The amendment was carried by an overwhelming majority. Rhos will therefore remain in darkness.

WRIGHT'S GAS FIRES.

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Otley Water Supply.—The Otley District Council have adopted plans, specifications, and general conditions for the construction of a new reservoir at March Ghyll, Middleton.

Margate Water Supply.—At the meeting of the Margate Town Council last Tuesday, the revised estimate for the Wingham water scheme, at a reduced cost of £89,729 (instead of £150,000, the sum formerly named), was agreed to, pending the consent of the ratepayers to go to Parliament for power to carry out the work. In addition to this, there will be a further outlay in providing for the supply of the villages adjacent to Wingham, which will bring the total cost of the scheme up to £120,000, or a reduction of £30,000 on the amount suggested in the original estimate.

Nottingham Water Supply.—At the meeting of the Nottingham City Council on Monday last week, the Water Committee reported that it was necessary for the efficiency of the present water supply that two new reservoirs should be made—one at Watnall, in the parish of Greasley, capable of containing 50,000 gallons, and the other at Wilford Hill, in the parish of South Wilford, capable of containing 2,000,000 gallons. The Committee also advised that the parishes of Ruddington and South Wilford should be included in the water district of the Corporation, on the same terms as those on which Burton Joyce was recently brought in. They therefore recommended that, in the Bill to be promoted by the Corporation in the ensuing session, clauses should be inserted giving power to acquire the land for the sites for the intended reservoirs and to construct the same, and to raise the necessary capital; also to include the above-named parishes in the water area of the Corporation. The report was adopted.

Enfield Water Supply.—The question of the water supply at Enfield is giving rise to some local trouble. For a long time it has been found that the supply is inadequate; and in order to cope with the demand, the District Council have for some months given the matter serious consideration, with the result that they were professionally advised to construct new works in the western portion of the district, at an estimated cost of about £40,000. They agreed to this recommendation, and acquired the necessary land. They did not, however, adopt the whole of their Engineer's proposal, but decided to apply to the Local Government Board for sanction to borrow £20,000, which it was believed would be ample to meet the existing demand. At the Local Government Board inquiry last week, opposition was offered to the scheme, on the ground that the Council had not approached the New River Company with the view of obtaining assistance. In reply to this, the Clerk (Mr. T. W. Scott) explained that in 1895 he was instructed to write the Company, and received a reply that they were not prepared to undertake the supply of the district. Enfield could not enter into an agreement with the Company unless the present works were abandoned. The Inspector promised to report the objections to the Board. A ratepayers' meeting followed, at which the majority of the speakers raised objections to the Council's proposal. A resolution was carried with unanimity, that a petition should be forwarded to the Board asking for another inquiry to be held before the question of sanction was considered.

Fight for Water Rights in Spain.—According to the Madrid correspondent of the "Daily Express," a dispute is raging in the province of Salamanca over the water rights of a river called "*El Hombre Muerto*" (the dead man's river), which flows past the rich township of Candelaria, to reach the industrious city of Bejar, which is noted for the finest cloth manufactures in Spain; it is, in fact, the Bradford of the Peninsula. The Bejar people, armed with all sorts of weapons, have invaded the territory of Candelaria, which they have laid waste—burning crops, slaying cattle, and killing every live thing in their *razzia*. They have besieged Candelaria, and burnt the suburbs and some houses not defended by the cowed farmers. The authorities have been set at nought, and troops are marching to the relief of Candelaria.

Investment of Trade Union Funds.—The statements which have been published to the effect that the leading Trade Unions have been considering whether they should invest their funds abroad, with a view of evading the recent decision of the House of Lords, are being contradicted. It is said, by those who are supposed to speak with authority, that while Trade Unions are naturally desirous, as far as possible, of avoiding litigation on the lines of the Taff Vale action, they have no intention of attempting to evade their legal liability by the removal of the funds abroad. The policy which is likely to be adopted is twofold. In the first place, most of the Unions will revise their rules in such a way as to limit the powers of officials of local branches, so that they will not be able to commit the Union in any unlawful act. The purely benevolent funds will also be separately invested, and earmarked for the particular objects for which they have been subscribed. In the second place, an endeavour will be made to obtain legislation to clearly define the responsibilities and privileges of Trade Unions.

Pensions for Birmingham Corporation Employees.—A meeting of a Special Joint Committee of the members of certain Committees of the Birmingham City Council was held at the Council House last Wednesday to consider the possible extension of the present superannuation scheme for workmen. It provides that where the workman has 20 years' continuous service, he becomes entitled to 7s. a week; on the expiration of 30 years, to 8s. 6d.; and 10s. a week when 40 years have been completed. It happens, however, that there is a percentage of workpeople under the Corporation, notably in connection with the gas-works, who are only employed during the winter months, or are engaged at uncertain intervals. The result is that, their labours not being continuous, they do not come under the superannuation scheme, or it may be that they are debarred from further employment in consequence of ill-health. In order to arrange some scheme for benefiting these men, a Joint Committee has been formed, consisting of Sir James Smith and Mr. Dexter (Public Works Committee), Alderman Beale (Water Committee), Alderman Martineau (Health Committee), and Messrs. Lloyd and Hallewell Rogers (Gas Committee); and Alderman Beale was elected Chairman. In the course of discussion, it was agreed that some scheme was desirable; and, with this admitted, the Committee adjourned, with the understanding that at the next meeting some practical suggestions will be laid before them.

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Increased Storage at the Solihull Gas-Works.—Messrs. Willey and Co., of London and Exeter, have lately completed for the Solihull Gas Company, under the supervision of the Manager (Mr. T. Jowett), a holder capable of containing 54,000 cubic feet of gas—thereby doubling the capacity of the one formerly in use. It is in two lifts, rising to a height of 29 feet, as compared with the 14-feet rise of the previous holder; while the old cast-iron columns have been replaced by lattice-work standards 33 ft. 4 in. high.

Cardiff Water Supply.—At a meeting of the Water Committee of the Cardiff Corporation last Friday week, the Water Engineer (Mr. C. H. Priestley) presented a report in which he stated that on the 20th ult. it was decided to apply to Parliament for a Provisional Order to enable the Corporation to borrow money for certain works now in hand and contemplated in the immediate future. In addition to the expenditure already sanctioned, there were, he said, certain other matters which had been brought before the Committee in his several reports from time to time. Many of these works would be necessary during the next few years, if the efficiency of the water-works was to be maintained; and the present would be an opportune time to obtain the necessary borrowing powers. Details of the proposed expenditure, amounting to £90,795, having been given, the Committee decided to apply for a Provisional Order to enable them to raise £91,000.

Water-Works Depreciation Account and the Repair of a Filtering Tunnel.—The Cork Corporation have just received, from the Local Government Board (Ireland), a copy of the report of the Official Auditor (Mr. J. H. Calvert) on the accounts of the borough for the year ending March 31 last. This is the first occasion on which the accounts of the Corporation have been subjected to a thorough scrutiny by an officer of the Board; and Mr. Calvert seems to have done his work in a very complete fashion. The report is interesting in regard to points of advice and suggestion. For example, he raises a question in regard to the "depreciation account, water-works fund." He points out that section 74 of the Corporations Improvement Act, 1868, gave the Corporation power to set aside, out of their revenue arising from the sale of water, a sum not exceeding £400 per annum, limiting the accumulations thereof in the aggregate to £2000. During the year, £1166 17s. 9d. was expended in repairing the filtering tunnel; and he finds considerable difficulty as to the legality of the action of the Corporation in utilizing the fund for this purpose, on the grounds that, although the wording of the section seems to sanction such a proceeding, he is confronted with the difficulty that, by passing this, a precedent might be established for appropriating this fund at some future time for purposes which should be met out of ordinary expenditure. The opening clause seems to imply that the fund was to be utilized in case of accidents due to causes which could not be anticipated; but as the section itself describes it by the word "depreciation," it would appear advisable that an opinion should be obtained for future guidance as to the interpretation and intent of the section. The report was referred to the Law and Finance Committee; so that an expression of opinion on the subject will no doubt be forthcoming.

Suffocation by Gas.—In the forenoon of Sunday, the 6th inst., Mrs. Nicoll, a widow, residing in Russell Street, Arbroath, was found dead in her own house. She was lying in front of the fireplace in her night-dress. The cock of a gas-bracket in the room was found to be turned half on, supposed to have been done by the deceased herself the previous evening, when she extinguished the gas. Death was certified to have been due to poisoning by gas.

The Destruction of a Dam at Dover.—The costly farce of dam-building and dam-destroying on the River Dour at Dover, to which reference was made last week, is to give place to the more serious, but perhaps more costly, course of legal proceedings. It was stated at the meeting of the Dover Corporation last Tuesday, that Mr. Bacon, the owner of the tanyard, who had erected the dam which the Corporation workmen subsequently destroyed, had accepted service of writ for injunction. The Corporation claim the water rights by purchase; and they desire to prevent Mr. Bacon from damming up the river, and diverting the water for his own purposes.

Hemel Hempstead Water-Works Purchase.—At the meeting of the Hemel Hempstead Town Council on Wednesday week, the Water Committee reported having considered the appointment of officials in connection with the water undertaking, and stated that Mr. A. F. Phillips, Consulting Engineer to the Water Company, had intimated his willingness to act in the same capacity for the Corporation on terms which he specified. Mr. Arthur Davis, the Resident Engineer to the Water Company for 18½ years, was re-appointed. The Town Clerk (Mr. Lovel Smeathman) reported that the loan of £2033, the amount of the arbitration expenses, had been received from the Public Works Loan Commissioners. A statement of expenses in connection with the purchase of the water undertaking was submitted. Among the items were the following: Taxed costs of obtaining the Act of Parliament, £2226; do. of the arbitration, £1615 (£1022 being the Corporation's costs and £593 the Company's); the Arbitrators' and Umpire's costs, paid on taking up the award, amounted to £418; and the purchase-money paid as per award, was £41,689—making a total of £45,948, which amount had been advanced by the Public Works Loan Commissioners. Interest and other items, however, left a balance of £293 overdrawn. The resignation of Mr. E. J. Jones, who had been Secretary and Collector to the Company for 33 years, was accepted. In presenting the report, Mr. Fisher (Chairman of the Committee) expressed regret that the Corporation had started the undertaking with a balance on the wrong side, and one which it would take some time to redeem. A cordial vote of thanks was passed to him for the time and labour he had devoted to carrying the scheme through. The Town Clerk mentioned that all Mr. Fisher had done had been at his own expense—and very considerable expense—and not one farthing had come to him out of the large sum spent for witnesses' allowances. In response, Mr. Fisher said he felt sure the undertaking would be of great benefit to the district. It was a unique affair, and one with which the Company reluctantly parted. They knew it was a good thing, and so did he; and the ratepayers who had gone into the details knew it also.

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Todmorden's New Reservoir.—About three years ago, the Todmorden Corporation obtained power to construct a reservoir at Gorpley; the time specified for the completion of the work being seven years. The first turf was cut 15 months ago; and there are now 230 men engaged in carrying out the contract. The capacity of the reservoir, when completed, will be 130 million gallons, and it will be capable of furnishing a daily supply of 690,000 gallons. The embankment, which will use up no less than 170,000 tons of material, is being rapidly constructed; and water to the depth of 20 feet has already accumulated in the reservoir. It will have a maximum depth of 84 feet.

Provincial Gas and Water Shares and Stock.—Our advertisement columns have recently contained announcements of quite a number of sales of gas and water stock in provincial companies. The Newcastle Gas Company have been advertising a sale by auction of £40,000 of ordinary stock, the Woking Gas and Water Company 2000 £10 ordinary shares, and the Dover Gas Company £10,000 new ordinary stock. This week there are newcomers in the Chester United Gas Company, who give notice of an issue of £10,000 ordinary stock; the Wellingborough Gas Company, who are selling 600 £10 shares; the Wisbech Water Company, who are offering 800 new £10 ordinary shares; and the Bristol Water Company, who will offer on the 24th inst. £15,000 of 7 per cent. consolidated ordinary stock. There is a very good selection here of choice investments.

Extension of the South Molton Gas-Works.—The South Molton Town Council have had under consideration for the past few months various proposals for the improvement of the gas-works. One was to remove the works to an entirely new site near the railway; but the cost of this was regarded as prohibitive. Mr. H. A. Willey, of Exeter, who was consulted, recommended the transfer of the works to the more convenient site; and, failing this, he placed before the Gas Committee estimates for altering and improving the present works. The cost of the whole scheme recommended was £2800; but the Gas Committee, after long consideration of the matter, came to the conclusion that an expenditure of £1026 on purifiers, meter, a larger gasholder, &c., would meet present requirements. In the Council on Tuesday last, an attempt was made to cut this down still further, by eliminating a sum of £426 proposed to be spent in extending the storage accommodation. The recommendation of the Committee was, however, adopted. One of the speakers (Mr. J. A. Kingdon) expressed the opinion that the Gas Committee were acting wrongly in the matter by not going in for the complete scheme, and seeking their reward in a larger consumption of gas. There was not half the quantity of gas burnt in the town that there ought to be. It was stated that the consumption had increased by 50 per cent. since the Town Council acquired the works five years ago.

Water Supply Scheme for the Bridgwater District.—Last Thursday, Colonel A. J. Hepper, R.E., attended at the Bridgwater Council Chamber to hear an application by the Rural District Council of Bridgwater for sanction to borrow sums, amounting to £24,000, for the purpose of furnishing a water supply to certain places, and constructing works in the parishes of Bridgwater Without, Broomfield, Chilton Trinity, and Goathurst. Mr. F. E. Weatherly, who represented the applicants, pointed out that the number of people living in the district which the scheme was promoted to benefit was 6559. The questions the Inspector would have to decide were, firstly, whether from a sanitary point of view a water supply was needful; secondly, whether from an engineering point of view the scheme in question was practicable and sound; and, thirdly, whether from a financial point of view it was fair and reasonable. The history of the proposal was short in one sense, but was very startling. Since 1895 there had been a great deal of discussion as to the necessity of a water supply for the parishes in question, on account of the reports made by the Medical Officers of Health, and the Inspector of Nuisances, and the complaints of the County Council. The latter body, ever since 1897, had been urging the District Council to do their duty with regard to the parishes, and give them a proper supply of water. In addition to these reasons, the Medical Officer of Health for the district (Dr. F. J. C. Parsons) would state that they were at present most inadequately served, that the wells were shallow, that the drainage was near the water supply, and that the water for domestic purposes was not really fit to drown a dog in. With regard to the second point—as to whether the scheme was practicable—he thought the Inspector would be able to judge for himself, having seen the site of the works. As to the third point, the assessable value of the parishes concerned was £25,475 for special purposes, and Mr. Weatherly explained minutely the manner in which it was proposed to apportion the cost. The principal evidence was that of the several Medical Officers of Health, who stated that the water in each parish was very impure, and had caused disease. They gave it as their opinion that the scheme of water supply proposed was most essential. Engineering evidence having been given, the inquiry closed.

The Ellesmere Urban District Council have accepted the tender of Messrs. Jonas Drake and Son for new retort-beds at their gas-works.

The Aberyschan Gas Company have placed an order with Messrs. R. Dempster and Sons, Limited, of Elland, for extensions to the carbonizing plant at their works.

At the opening meeting of the London County Council for the new session last Tuesday, it was referred to the Public Control Committee to consider and report upon the whole question of the smoke nuisance in London, and the means which may be adopted to remedy the evil.

An issue of £7800, the balance of the new 5 per cent. preference stock Class E of the South Staffordshire Water Company, is offered for sale by public tender, in lots of £100 each. Notices of allotment will be sent out by the Company on or before Monday, the 11th prox.; and the date for payment of the whole amount to their bankers is fixed for the 30th, after which day the stock will rank for dividend.

The output of the German-Austrian Mannesman Tube-Works, Berlin, amounted in the financial year which has just expired to 27,227 tons—an increase of 1200 tons on the previous year. The value of the output, however, decreased by 1,032,658 marks; and the manufacturing profits fell from 4,437,237 to 3,986,128 marks. The net profit amounts to 1,516,183 marks, against 2,072,298 marks for the year 1899-1900.

At a meeting of the General Purposes Committee of the Swansea Corporation last Wednesday, the Town Clerk reported that the Water and Sewers Committee had considered the question of seeking parliamentary powers for an extension of the period sanctioned for the construction of the Cray Water-Works. As the existing powers would cease in June, 1902, it would be necessary to promote a Bill in the next session of Parliament.

On Monday evening last week a deputation from the Bury Corporation visited the Dukinfield Town Hall to inspect the incandescent lighting installation put in by the Welsbach Incandescent Gas-Light Company, Limited. All the lights were turned on, and the party were shown through the building by the Borough Surveyor (Mr. S. Hague), and the lighting arrangements explained by Mr. J. E. Gresty. General satisfaction was expressed at the effect produced.

Messrs. Blake, Barclay, and Co. have in hand a very large installation of coal unloading, storing, and charging machinery for Messrs. Henry Tate and Sons, Limited, sugar refiners, of Liverpool. It includes special appliances for taking coal from the barges, depositing it in the large coal-store, and distributing it thence to 23 Lancashire boilers. They are also engaged upon the coal elevating and conveying plant for the electrical station of the Edinburgh Corporation Tramways at Portobello, and have a large amount of work on hand for Sydney and Hong Kong.

Mr. W. Arnott, the enterprising Manager of the South African Lighting Association, has lately returned to the Cape after a visit to the Glasgow Exhibition and some of the chief European cities. He is strongly impressed with the value of the high-pressure gas system for street lighting; and he intends placing several lamps in Main Street, Port Elizabeth, to demonstrate its capabilities. On the Continent, Mr. Arnott noticed with gratification that gas more than holds its own—it having superseded the electric light both in shops and in the public thoroughfares. He shares the opinion of everyone who has seen it, that Paris is the best-lighted city in Europe.

In view of the increased attention which is being given by gas managers to the subject of the mechanical conveyance of materials in gas-works, special interest attaches to the new illustrated catalogue of elevating and conveying machinery just issued by Messrs. Graham, Morton, and Co., Limited, of Leeds. It consists of a series of well-executed reproductions of photographs of work which the firm have erected during the last few months, and therefore shows their various labour-saving and other appliances in the latest developments. The book is tastefully got up, and is worthy of a place upon the desk of all gas managers, especially those contemplating the reconstruction of carbonizing plant or the remodelling of retort-houses.

The late Mr. William Woodall was a diligent collector of newspaper extracts, to the arrangement of which he was in the habit of devoting his Saturday evenings. So numerous were these "cuttings," that they fill 27 bound volumes, which, thanks to the generosity of the deceased's brother, Mr. Corbet Woodall, and in accordance, we understand, with the expressed wishes of the collector, have now come into the possession of the town of Burslem, having been accepted by the Corporation as a contribution to the Wedgwood Institute (the Free Library). At the meeting of the Corporation on Monday last week, Alderman Wilcox Edge, referring to the latest acquisition, remarked that the volumes were "a most valuable collection, containing the history of Burslem, and largely the history of the whole district, within the period which they embraced."

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For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

GAS TAR wanted.

BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

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Telegraphic Address: "GASKING, LONDON."
Telephone Number: Holborn 121.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
19, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "LUMINOSITY."

PATENTS FOR INVENTIONS.
Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHATE OF AMMONIA
SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.
For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."
Largest Practice and most Up-to-Date Works in Britain.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

TO GAS AND WATER OFFICIALS.

HIGH-CLASS CYCLES at Reasonable and LOW PRICES. Guaranteed and sent on approval. For Cash or Gradual Payments. Catalogue post free. Old Machines Exchanged or Repaired.
MELROSE CYCLE COMPANY, COVENTRY.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PREPAYMENT METER WORK.

CONTRACTS are undertaken by William EDGAR for FITTING UP HOUSES, complete with the PENNY-IN-THE-SLOT INSTALLATIONS. Gas Companies or Corporations indemnified against loss through Accidents, &c. Thousands of Houses have been fitted up by me under this System. Estimates free.
BLENHEIM HOUSE, 23, Lower Mall, HAMMERSMITH.
Telegrams: "Gasoso."
Telephone No. 14 Hammersmith.

NOTICE is Hereby Given, that the following has been received from an eminent Gas Engineer:—"After inspecting your Patent Hot-Coke Conveyor, I had no hesitation in recommending its adoption at these Works, as no automatic apparatus, in my opinion, could possibly carry away the hot-coke, as drawn from the retorts, with greater freedom from friction and wear.
"With your continuous steel table, carried by the rollers on the rolled trough, I am satisfied I have ordered a strong, simple, and durable design of hot-coke conveyor."
Applications for drawings, specifications, and Tenders for Hot-Coke Conveyors should be addressed to
GILBERT LITTLE, Smethwick.

SON of a well-known Gas Engineer desires Situation as MANAGER in Gas Company's Show-Room. Thoroughly competent to advise Consumers in Cooking, Heating, and Lighting. Testimonials can be given.
Address No. 3757, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

EX-ARTICLED Pupil (age 22) desires position as ASSISTANT to the Engineer of a Gas Company in larger sized Town. Five-and-a-half Years' Experience in similar position on Works of 70 millions. Small Salary to start.
Address No. 3760, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an engagement as Manager or SECRETARY and MANAGER of a Gas or Water-Works. Age 29. Experienced in the construction and working of Modern Gas Plant and Pumping Machinery. Careful and attentive to duties. Excellent Testimonials. No objection to go abroad.
Address No. 3754, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A GENTLEMAN of considerable experience in the management of Foreign Gas-Works (his last engagement being 17 years Manager and Engineer of Works of 600 millions per annum) is desirous of obtaining the direction of Works abroad of any magnitude. Highest references.
Address, No. 3761, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN requires Engagement in a Gas-Works. Four-and-a-half Years' experience in the Works and Drawing Offices of Messrs. Geo. Waller & Co., of London and Stroud.
F. H. WEDD, 165, Queen Victoria Street, LONDON, E.C.

TO ENGINEERS AND GAS MANAGERS.

DRAWINGS, Specifications, and Tracings prepared from Engineers' Sketches or Instructions by experienced Draughtsmen.
Address No. 3758, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, at once, a good all round GAS-FITTER.
Apply, by letter, to GENERAL MANAGER, Gas-Works, MILL HILL, N.W.

WANTED, Two good Gangers for Retort-House. Accustomed to Inclined Retorts. Wages 6s. per Shift of Eight Hours. Overtime paid for.
Apply, with References, stating Age, to the ENGINEER, City Gas-Works, Saltley, BIRMINGHAM.

WANTED, by the Aylesbury Gas Company, a qualified GAS-FITTER. Good character. State Wages. Preference to a Temperance Man and non-Smoker.
Apply to Mr. LANE, Gas-Works, AYLESBURY.

WANTED, a reliable young Man as good all round GAS-FITTER, especially good on Compo. and Incandescent Burners.
Apply, by letter, stating Age, Reference, and Wages required, to S. TEMBLETT, Gas-Works, ANDOVER.

WANTED, a Man to set Retorts and do general Bricklaying at Works near Birmingham. Must be used to Regenerative Settings. Permanent Situation to suitable Man.
State Age, Experience, Wages required, &c., to No. 3753, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an energetic young Man as ASSISTANT in a Gas-Works near London, making about 50 millions. Must be competent to assist in keeping Accounts, and the preparation of Drawings. Salary £70 per annum.
Apply, with Testimonials and Specimen of Drawings, stating Age, to No. 3759, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Newcastle-upon-Tyne and Gateshead Gas Company require a SUPERINTENDENT for their Public Lamp Department. Applicants must have had previous experience.
Application to be made, on or before the 22nd of October, in Candidate's own Writing, stating Age, Salary required, and giving Particulars of Experience with *copies* of recent Testimonials, to
THOS. WADDOM, Secretary.
Newcastle-upon-Tyne.

FOR SALE—One 12 feet Square Purifier and VALVES. In splendid condition. Can be seen at the Kelso Gas-Works.
Offers accepted by ALEX. C. YOUNG, Manager.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY Gas Engineer, Thornhill, DEWSBURY.

TO BE SOLD—
GASHOLDER (and Cast-Iron Tank), 20,000 cubic feet capacity.
CENTRE-VALVE, 15 in. diameter, by Walker, for Four Purifiers.
Four PURIFIERS, 10 feet square, in line, with Planed Joints, Walker Centre-Valve, Covers, and Traversing Crab Lifting Gear. Will be refixed equal to new.
Write J. WRIGHT, Bridge House, BLACKFRIARS, E.C.

BOROUGH OF LEIGH.

(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee of the above Corporation invite TENDERS for the supply of about 200 Tons of natural OXIDE OF IRON.
Forms of Tender and any further Particulars may be obtained from the Manager, Mr. John Foster, Gas and Water Works, Leigh.
Sealed Tenders, endorsed "Tender for Oxide of Iron," to be sent to me the undersigned not later than Twelve o'clock noon, on Saturday, the 19th day of October, 1901.
By order,
PEREGRINE THOMAS, Town Clerk.
Town Hall, Leigh, Lancs.,
Sept. 30, 1901.

LEEK URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

TENDERS are invited for the supply of 170 Tons of natural OXIDE OF IRON.
Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, Town Hall, Leek, to be delivered not later than Saturday, the 26th of October, 1901.
Further Particulars may be obtained from the undersigned,
C. HENSHAW, Clerk to the Council.
Town Hall, Leek,
Oct. 12, 1901.

BOROUGH OF DARWEN.

TENDERS FOR GAS COKE.

THE Corporation of Darwen are prepared to receive TENDERS for the purchase of their surplus forked COKE during the next Twelve Months.
The total quantity for which Tenders are asked is about 6000 Tons. The Coke will be delivered in Waggons on the Corporation Gas Siding, or sold as it lies on the Gas-Works Yard.
Sealed Tenders, endorsed "Gas Coke," stating quantity, mode of delivery, and price per ton, must be sent to me on or before Saturday, Oct. 19.
No Tender necessarily accepted.
Further Information may be obtained from the Gas Engineer.
WILLIAM P. HALLIWELL, Town Clerk.
Town Clerk's Office, Darwen,
Oct. 1, 1901.

BOROUGH OF CHORLEY.

TO COLLIERY OWNERS AND OTHERS.

THE Chorley Corporation invite Tenders for the supply of 8000 Tons of GAS SLACK, required at their Gas-Works for a period of Eight Months from the 1st of November, 1901, to the 30th of June, 1902.
Forms of Tender and any further Information may be obtained on application to Mr. J. W. Allin, Gas Engineer, Chorley.
Tenders, endorsed "Gas Slack," to be sent to me, on or before Tuesday, the 22nd inst.
The Corporation do not bind themselves to accept any Tender.
By order,
JNO. MILLS, Town Clerk.
Town Hall, Chorley,
Oct. 4, 1901.

BOROUGH OF CHORLEY.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the following:—

1. Purchase of surplus TAR, about 450 Tons.
2. Supply of LUMP LIME, SMALL LIME, or LIME ASHES, 450 Tons or thereabouts.
3. Supply of VITRIOL, 180 Tons or thereabouts.

For Eight Months commencing the 1st of November, 1901, to the 30th of June, 1902.

Forms of Tender for Acid, or any other Information, may be obtained on application to Mr. Jno. W. Allin, Gas Engineer, Chorley.
Tenders, duly endorsed, to be delivered to the undersigned on or before Tuesday, the 22nd of October, 1901.
The Corporation do not bind themselves to accept any Tender.
By order,
JNO. MILLS, Town Clerk.
Town Hall, Chorley,
Oct. 4, 1901.

TO INVESTORS AND CAPITALISTS.

MESSRS. PENDERED & SONS are Instructed to OFFER FOR SALE by PUBLIC AUCTION, in Lots, at the Hind Hotel, Wellingborough, on Wednesday, Oct. 30, 1901, at Five for Six o'clock in the Evening,
600 £10 SHARES in the WELLINGBOROUGH GASLIGHT COMPANY, LIMITED.
The Shares will bear Dividend as from the 1st of January, 1902.
The Dividend paid for the last Three Years on the £10 Shares of the Company has been at the rate of £9 per centum per annum, free from Income-Tax. As the business of the Company is steadily increasing, and there is an ample Reserve Fund, it may be confidently expected that this Dividend will be maintained in the future.
There are no Founders or Preference Shares in the Company; and all the Shares rank for Dividend according to their relative nominal value.
Further Particulars may be obtained of the AUCTIONEERS, WELLINGBOROUGH; Mr. S. H. KIMBELL, the Gas Company's Office, Commercial Place, WELLINGBOROUGH; or of Messrs. SHARMAN JACKSON AND ARCHER, Solicitors, West End House, WELLINGBOROUGH.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

(Incorporated by Act of Parliament.)

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Association will be held at the City Terminus Hotel, Cannon Street, London, E.C., on Tuesday, the 5th of November next, at 2.30 p.m. precisely, when a Report will be made to the Proprietors, a Dividend declared for the Half Year ended the 30th of June, 1901, and the usual Ordinary Business of such Meeting transacted.

Notice is Hereby also Given, that the CAPITAL STOCK TRANSFER BOOKS WILL BE CLOSED from the 22nd inst. to the 5th prox., both days inclusive.

The Dividend will be paid on the 12th of November.

By order of the Board,
Robert W. Wilson,
Secretary.

21, Austin Friars, London, E.C.,
Oct. 14, 1901.

THE ORIENTAL GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that an EXTRAORDINARY GENERAL MEETING of the Oriental Gas Company, Limited, will be held at the Offices of the Company, Finsbury House, Blomfield Street, in the City of London, on Wednesday, the 23rd day of October, 1901, at Eleven o'clock in the forenoon precisely, when the following Resolution will be proposed:—

"That the capital of the Company be reduced by reducing the amount of each of the 30,000 shares of £5 each, on each of which shares the sum of £4 10s. has been paid, to a share of £4 10s. fully-paid, and cancelling the uncalled Capital of Ten Shillings per share on such £5 shares, and by reducing the amount of each of the 15,000 shares of £5 each, on each of which shares the sum of £1 has been paid, to a share of £1 fully-paid, and cancelling the uncalled capital of £4 per share on such last above-mentioned £5 shares."

Should the Resolution be passed by the required majority, it will be submitted for Confirmation as a Special Resolution to a Second Extraordinary Meeting which will be subsequently convened.

By order of the Board,
H. J. Luff,
Secretary.

Finsbury House, Blomfield Street,
London, E.C., Oct. 14, 1901.

By EDWIN FOX and BOUSFIELD,
At the Auction Mart,
On Wednesday (to-morrow), Oct. 16, at Two o'clock, in Lots.

By order of the Directors, and pursuant to the Auction Clauses of the Company's Act of 1899.

WOKING WATER AND GAS COMPANY.

£20,000 NEW CAPITAL, in 2000 £10 ORDINARY SHARES, in Lots of Ten Shares each.

THE Shares form part of an authorized issue of £120,000, have the same powers and privileges, and rank *pari passu* with the existing Capital, now paying a Dividend of £4½ per cent. per annum, and are entitled to a Dividend not exceeding £7 per cent. per annum; thus offering a thoroughly sound and improving Investment.

Particulars of the Secretary at the Company's Office, 5 and 6, Great Winchester Street, E.C.; Company's Solicitors, Charles A. Bannister and Reynolds, 70, Basinghall Street, E.C.; and at Messrs. Edwin Fox and Bousfield's Office, 99, Gresham Street, Bank, E.C.

NORTH MIDDLESEX GAS COMPANY.

28 £10 ORIGINAL SHARES, Dividend 10 per cent. per annum, and
30 £10 ORDINARY SHARES, Dividend 7 per cent. per annum.

MESSRS. EDWIN FOX & BOUSFIELD will include in their Stock and Share Auction at the Mart, on Wednesday (to-morrow), Oct. 16, at Two o'clock, in Lots, the above Shares.

Particulars at the Auctioneers' Office, 99, Gresham Street, Bank, E.C.

WISBECH WATER-WORKS COMPANY.

DESIRABLE INVESTMENT.

TO be Sold by Auction, by Mr. Joseph JOHNSON, at the Public Hall, Wisbech, on Thursday, the 24th day of October, 1901, at Three o'clock precisely, subject to such Conditions as will be then produced, and in Lots intended to suit the convenience of Purchasers,

800 NEW ORDINARY SHARES
Of the Nominal Value of £10 each in the
WISBECH WATER-WORKS COMPANY.

The above Shares will be issued and sold under the authority of the Wisbech Water Order, 1884, which limits the Annual Dividend payable by the Company upon Shares issued under the said Order to 7 per Cent.

A payment of 20 per Cent. of the Purchase Money will be required at the time of sale, 20 per Cent. on the 25th day of January, 1902; 20 per Cent. on the 26th day of April, 1902; 15 per Cent. on the 28th day of July, 1902; 20 per Cent. on the 24th day of December, 1902; and the balance (5 per Cent.) on the 30th day of June, 1903.

Purchasers will be entitled to Interest calculated on the respective amounts of their paid-up calls (except the first) after the rate of £5 per Cent. per annum out of the Profits of the Half Years ending the 30th day of June, 1902, the 31st day of December, 1902, the 30th day of June, 1903, and subsequently to the Half-Yearly Dividends of the Company, which will from time to time become due upon their respective Shares.

Any Purchaser wishing to pay the whole of his Purchase Money at once, or to accelerate the payment of his calls, may arrange to do so on application to the Clerk.

By order,
Robt. Dawbarn,
Clerk to the Company.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards' Offices, 18, Finsbury Circus, E.C.

By order of the Directors of the

REDHILL GAS COMPANY.

£5000 ORDINARY "B" STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Oct. 28, at Two o'clock, in Lots.

Particulars of the Auctioneer, 18, Finsbury Circus, E.C.

By order of the Executors of the late Mr. George Cuthbert, Senr.

GAS STOCKS AND SHARES

IN THE

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY; COLNEY HATCH GAS COMPANY; WALTHAM ABBEY AND CHESHUNT GAS AND COKE COMPANY; AND WORTHING GAS COMPANY.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Monday, Oct. 28, at Two o'clock precisely, in Lots.

Particulars of the Auctioneer, 18, Finsbury Circus, E.C.

By order of the Directors of the

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

NEW ISSUE OF 2000 £10 ORDINARY SHARES,

Ranking for a Standard Dividend of 7 per cent., subject to the Sliding-Scale; the Dividends on similar Shares in the Company having since 1884 been regularly paid at the rate of 7½ per cent. per annum.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, London, E.C., on Monday, Oct. 28, at Two o'clock precisely, in Lots.

Particulars may be obtained at the Head Offices of the Company in D'Olier Street, Dublin, and of the Auctioneer, 18, Finsbury Circus, E.C.

CHESTER UNITED GAS COMPANY.

THE Directors of the Chester United Gas Company give Notice that

£10,000 ORDINARY STOCK
OF AND IN THE
CHESTER UNITED GAS COMPANY,

bearing a Maximum Dividend of £5 per cent., under the powers of the Chester Gas Act, 1901, will be OFFERED FOR SALE BY AUCTION by

Messrs. BRANCH & LEETE,

on Thursday, the 24th of October, 1901, at Three o'clock in the Afternoon precisely, at the Law Association Rooms, Cook Street, Liverpool, subject to the Conditions of Sale, which will be then produced.

The Stock will be offered in Lots of the nominal amount of £100 each, and will be issued to each purchaser as paid-up Stock after the full payment of the Purchase Money.

For further Particulars, apply to Mr. James Pye, Gas Offices, Cuppin Street, Chester; or the Auctioneers, Messrs. Branch and Leete, Hanover Street, Liverpool.

BRISTOL WATER-WORKS COMPANY.

SALE OF ORDINARY STOCK.

MESSRS. ALEXANDER, DANIEL, & CO. will SELL BY AUCTION, at the Bank Auction Mart, Corn Street, Bristol, on Thursday, the 24th of October, 1901, at Three o'clock in the Afternoon,

£15,000

BRISTOL WATER-WORKS SEVEN PER CENT. MAXIMUM CONSOLIDATED ORDINARY STOCK, IN LOTS OF £100.

The above £15,000 Stock is part of the 7 per cent. Maximum Consolidated Ordinary Stock, amounting to £690,000, created under the Powers of the Bristol Water-Works Acts, 1888, 1889, and 1895.

The Dividend is subject to proportionate diminution whenever the maximum Dividend to which each class of Ordinary Shares or Ordinary Stock of the Company is entitled shall not be paid in full, but such diminution may be made up in subsequent years.

For further Particulars and Conditions of Sale apply to the Auctioneers, Bank Chambers, Corn Street, Bristol (and 3, Gracechurch Street, London, E.C.); to Fussell and Co., Solicitors, 36, Corn Street, Bristol; or to

Alfred J. Alexander,
Secretary and General Manager.

Bristol Water-Works Office,
Small Street, Bristol.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
GAS ENGINEERS' AGENTS AND CONTRACTORS FOR
Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

DOVER GAS COMPANY.

IMPORTANT ISSUE OF £10,000 OF NEW STOCK, Under the Provisions of the Dover Gas Act, 1901.

MESSRS. WORSFOLD & HAYWARD are favoured with Instructions from the Directors to SELL BY AUCTION, at the Metropole Hotel, Dover, on Thursday, the 17th of October, 1901, at Three o'clock p.m. precisely, in convenient Lots,

£10,000 OF NEW ORDINARY STOCK
IN THE
DOVER GAS COMPANY.

This Stock is in all respects equal to the existing Stock and Shares, which have paid the full Parliamentary Dividend of 7½ per cent. since 1874.

The present price of gas is 2s. 11d. per 1000 cubic feet, whereas the price authorized by the Company's Act is 5s. 3d.; thus giving ample security for the payment of the full Dividend on the increased Capital, apart from the increasing consumption.

Particulars, with Conditions of Sale, may be obtained of the Secretary of the Company, Mr. George Fielding, Solicitor, 14, Snargate Street, Dover; at the Company's Offices, Russell Street, Dover; and of Messrs. Worsfold and Hayward, Auctioneers, Surveyors, and Estate Agents, Dover and 80, Cannon Street, London, E.C.

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By WALTER GRAFTON, F.C.S.,

Lecturer on Gas Manufacture, &c., at the Polytechnic Institute, Regent Street, and of the Gaslight and Coke Company, London.

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The Gas World says: "Mr. Grafton has produced a fairly complete and comprehensive treatise . . . We have no hesitation in recommending all our readers who are interested in gas-fitting work not merely to buy a copy of his book, but to read it."

The Journal of Gas Lighting says: "Mr. Grafton has well covered his ground."

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ALFRETON IRON-WORKS, DERBYSHIRE,

AND

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Inquiries Solicited.

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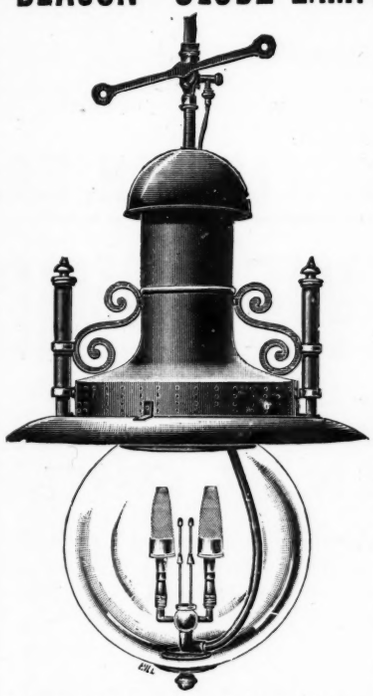

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Applications for Colonial and Foreign Agencies desired.

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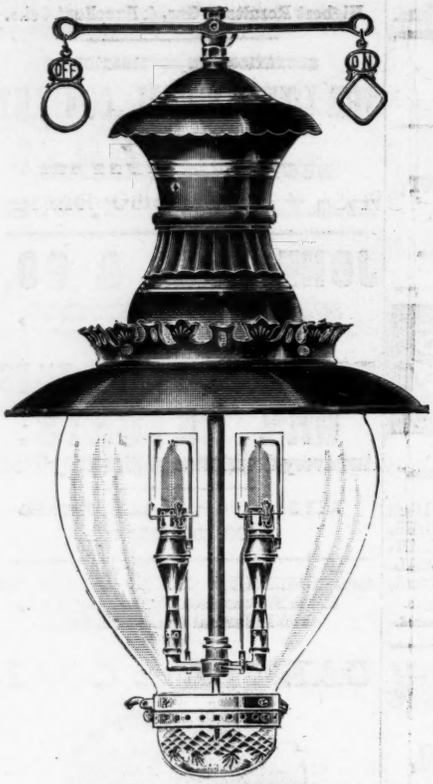

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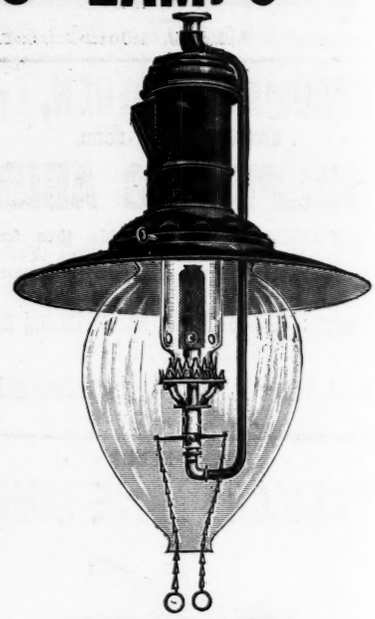

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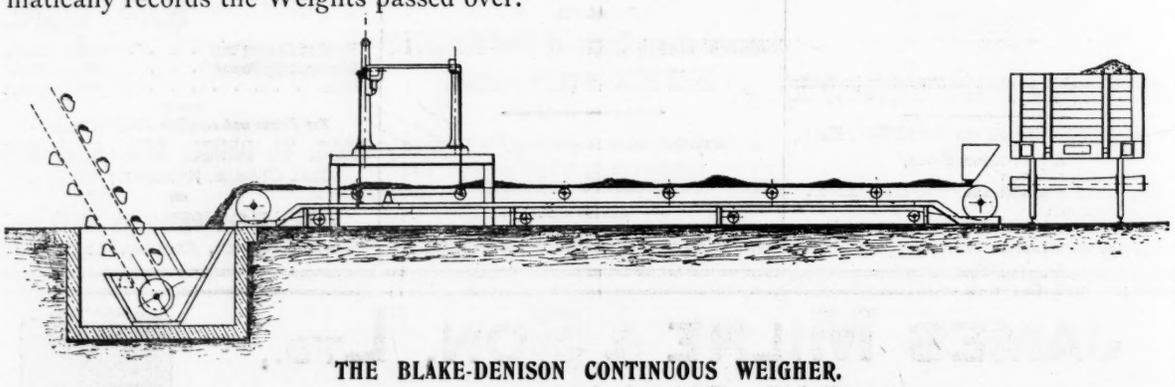

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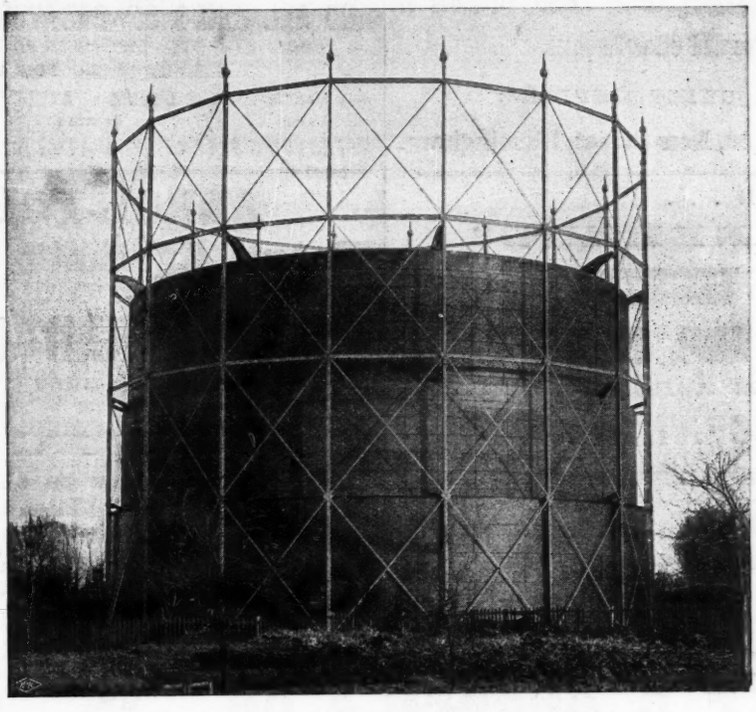
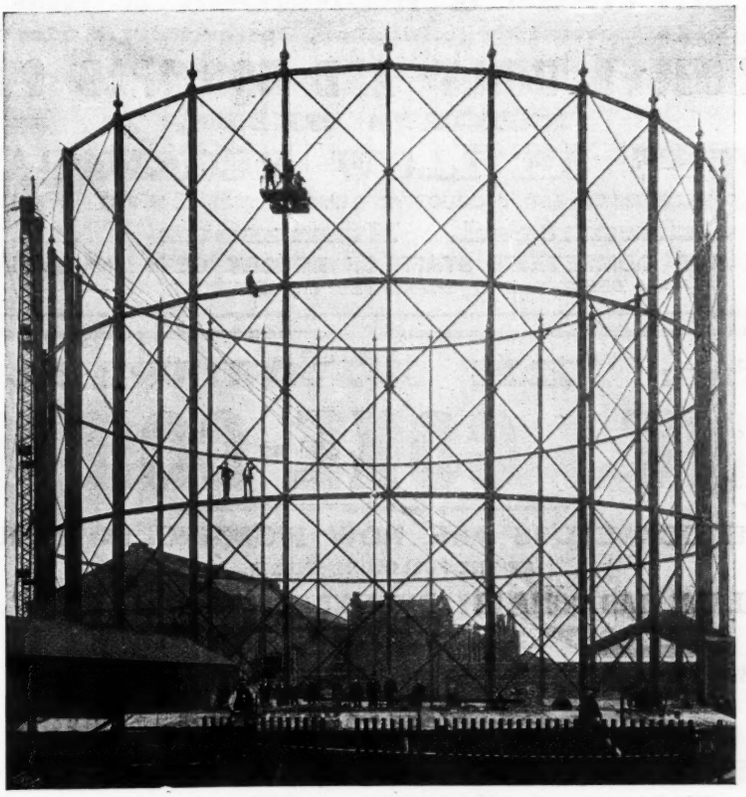


Three-Lift Gasholder and Steel Tank, 90 feet diameter by 14 feet deep, recently erected for the EPSOM GAS COMPANY.



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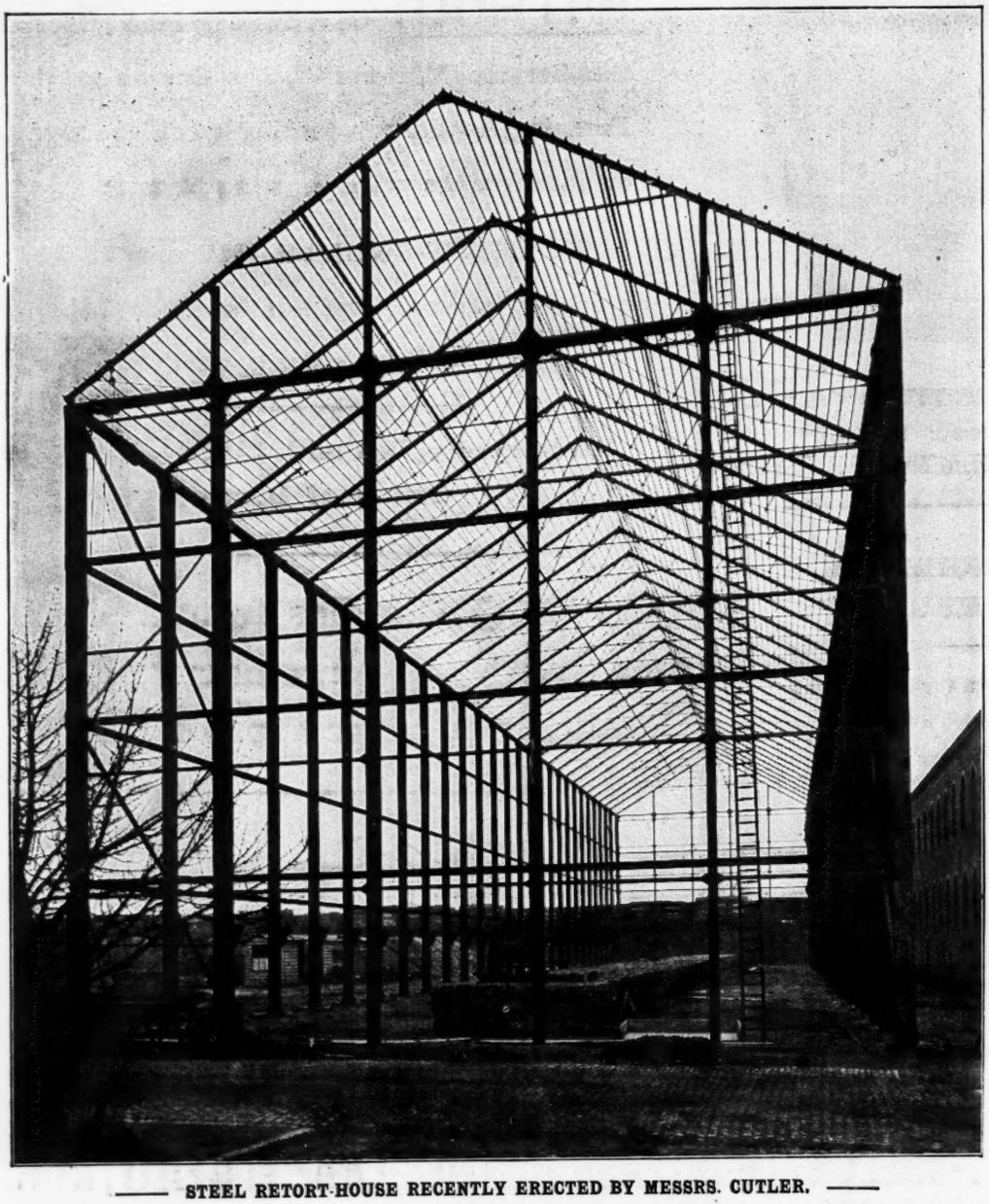

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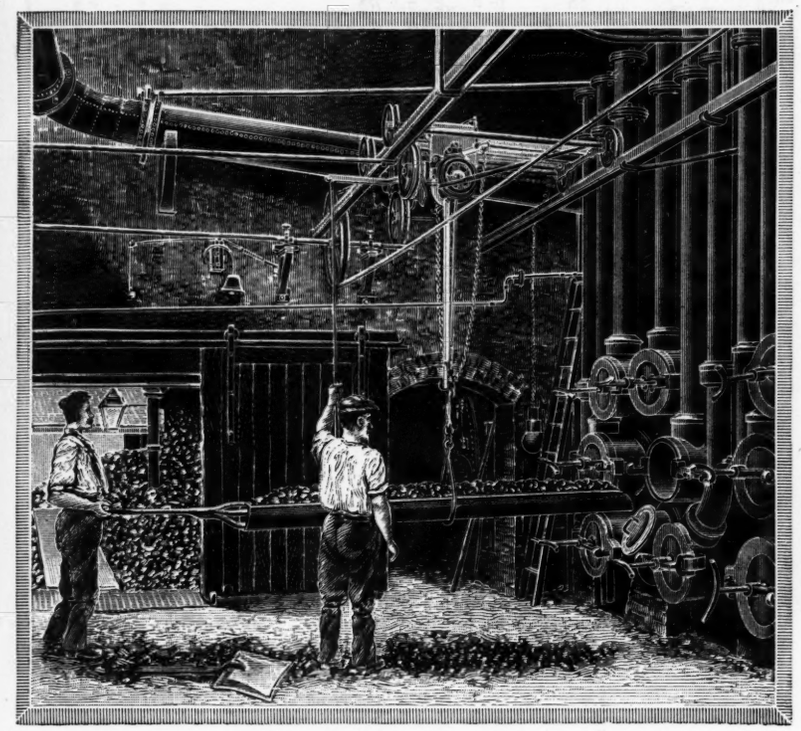

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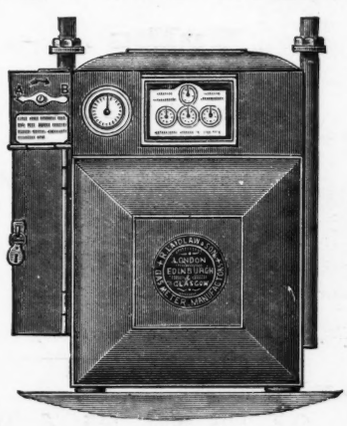

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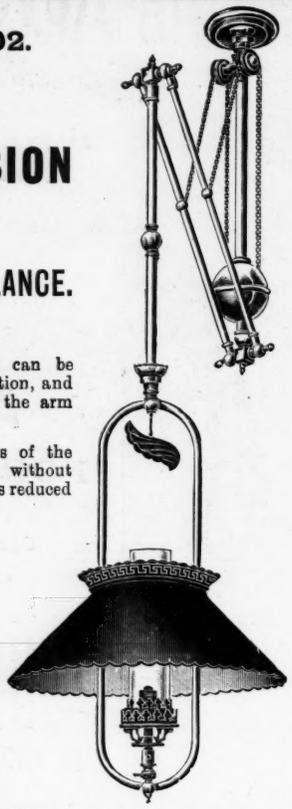

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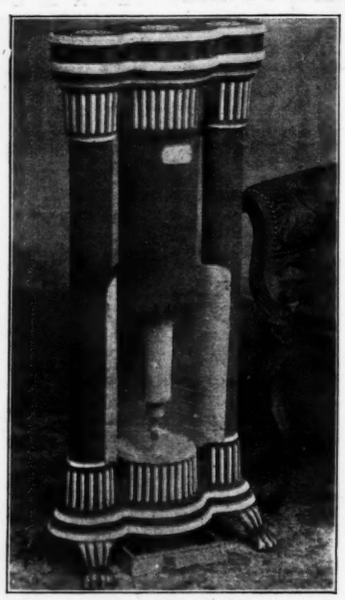

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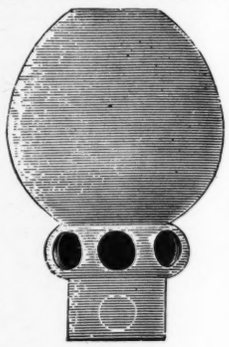

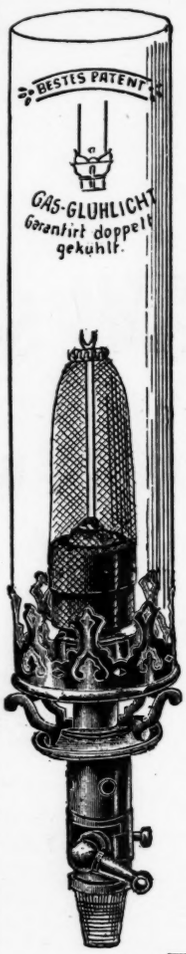

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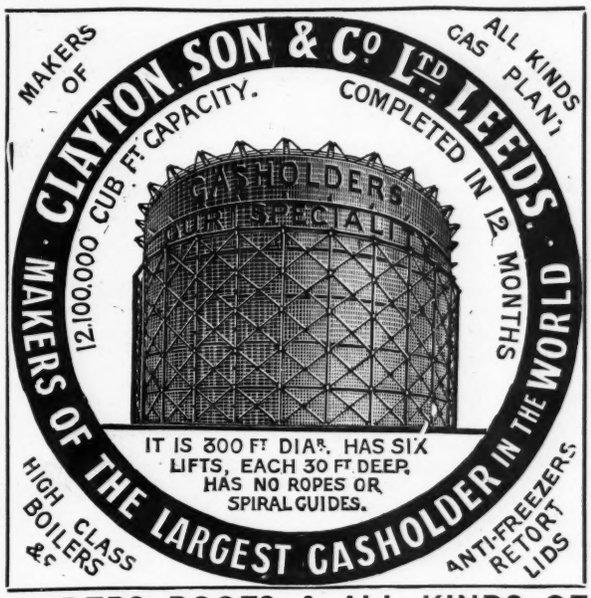
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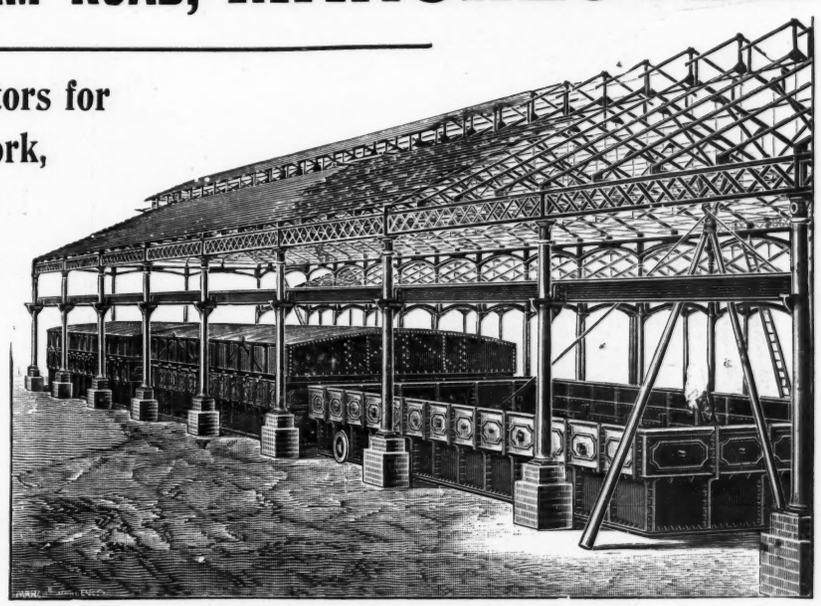

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